



The Center for Educational Technologies®

TOOLBOX TRAINING

Mine Safety

Instructor

TOOLBOX TRAINING

Table of Contents

This workbook contains the following sections. The first two pages are the instructor version, followed by the version to distribute to miners in training if so desired.

Disclaimer

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From left, images 1, 4, and 5 in row of photos on cover courtesy of Kelly Michals.

September 2012

TOOLBOX TRAINING

Tips for the Trainer

What is toolbox training?

Toolbox training refers to brief training sessions that take place at the worksite. Toolbox training sessions can be an effective form of maintenance training to refresh people on procedures, policies, and best practices for working safely. These sessions provide opportunities to discuss how everyone at the mine has a role in the success or failure of the health and safety program.

This training program contains 33 accident descriptions organized by topic. Each description is based on an investigation report from an incident that occurred in a U.S. mine. These descriptions are followed by open-ended discussion questions and best practices that you can tailor to meet the needs of your site. Use these narratives to capture the interest of your miners. Then lead the miners in rewriting the story as it applies to them and their workplace. Bring out what best practices the victim did not use and try to get workers to open up about similar experiences they have witnessed and what they have learned.

When, where, and how long?

Ideally, toolbox training would take place at the beginning of a shift. If you get everyone together at the end of a hard day of work, the last thing they're going to want to do is have a meeting.

You need room for everyone to sit or stand comfortably with as few distractions as possible. Training doesn't need to take place in a classroom, but it needs to be relatively quiet. Everyone needs to be easily seen and heard. If the training is related to a specific piece of equipment, hold the meeting next to the equipment if possible.

Each accident case study is intended to be completed in roughly 10 or 15 minutes. You could combine a couple of toolbox training topics for an effective 30-minute safety meeting.

What should I say?

Pick a topic and then select the accident most relevant to your miners. Prepare enough to be able to tell the story in your own words. Then, the trick is to get your miners talking. Discuss some of the causes of the hazard or accident, but don't let the group get caught up in identifying the persons involved or on placing blame. The point is to help prevent another similar accident from happening. After the hazard and accident have been explained and understood, discuss best practices and tips for avoiding similar accidents. Here, miners' active participation is the most important aspect of toolbox training. Be sure to ask questions that require more than a one-word response. Get input from the crew about concerns they have. Have workers identify examples of equipment or structures at your site that could lead to a similar situation. Encourage miners to share near misses or unsafe conditions observed in the past and how they were corrected. In addition, be sure to inform miners of any upcoming changes to equipment, procedures, or conditions on the job.

Does toolbox training satisfy refresher training requirements?

Safety meetings lasting at least 30 minutes, conducted by an MSHA-approved instructor, and addressing appropriate course content can satisfy eight-hour annual refresher requirements. Refresher training must addresses changes such as new procedures, new mining equipment, or new health hazards that could affect the health and safety of the miners. Total annual refresher training time must add up to at least eight hours. Miners must be notified that the sessions are part of annual refresher training. As always, training must be part of the mine's approved training plan and properly recorded by the operator on MSHA Form 5000-23 or on an MSHA-approved alternate form.

Instructor

BLOCKING

Toolbox Training

Choose one or more scenarios that best fit your site. Review the best practices.

Scenario 1

A 57-year-old mechanic at the surface shop of a deep mine was changing out a bad tie rod on a one-ton pickup truck with a manual transmission. The truck had been converted to a mantrip. The front end of the truck was raised on two jacks and the front wheels had been removed while the rear wheels supported the vehicle on the floor. A parking brake had not been set, and the truck had been left in gear. The mechanic had removed the power steering unit and was in the process of flushing the old power steering fluid. He asked a coworker to start the engine, then turn it off quickly to flush the fluid. The mechanic was lying on the shop floor under the truck near the front bumper. When the coworker started the truck, his foot slipped from the uncovered clutch pedal, the truck lunged forward off the jacks, traveling roughly 6 feet and crushing the mechanic, who died immediately.

What Went Wrong?

The parking brake should have been set and the truck not kept in gear when started. The clutch should have had a rubber friction/anti-slip cover. Suitable chocks should have been placed in front and back of the rear tires to block it securely.

When work is going to be done on elevated equipment while the engine is running, what would one alternative be to greatly reduce the danger of the equipment's lurching?

Elevate all drive wheels, tracks, etc., off the ground.

Scenario 2

A 37-year-old mechanic with 14 years of mining experience needed to remove the fuel tank from a Caterpillar end loader in order to clean the tank of contaminants. To get to the tank, the mechanic had to remove an 11,865-pound counterweight. The mechanic did not use any blocking materials to secure the counterweight against motion, nor did he or the other mechanic working on the end loader consult the manufacturer's service manual. There were eight bolts on each side of the counterweight. The mechanic had removed seven from each side. When the mechanic began removing the last bolt on one side, the counterweight fell and crushed him. He died from his injuries.

What Went Wrong?

The rear bumper assembly, which included the counterweight, should have been supported with a suitable lift truck and then tooling (blocking material) placed under the assembly before any bolts were removed.

If you are going to perform a repair task that you don't do regularly, what should your first step be?

Consult the manufacturer's service manual or computer service guide first to learn about any safety precautions that should be taken.

Scenario 3

A crew of miners were working topside, sinking a ventilation shaft for a deep mine. Two miners were working underneath the raised boom of a pivot hoist, removing a two-piece sheave wheel and hook assembly from the whip line. The boom was not blocked in position. The sheave is required to be installed on the whip line when the drill is being lowered into and raised from the shaft because of the weight of the drill. Both miners were working to remove the snatch block from the whip line underneath the elevated hoist boom. The miners did not realize that the hoist boom's left side top pendant line had hung on the overhanging catch beam mounted to the top of the dump tower chute. When the pressure from the hoist's boom descent caused the pendant line to release from the overhanging catch beam, the hoist boom fell 8 feet, striking the miners, fatally injuring one of them.

What Went Wrong?

The miners should not have been allowed to work under the boom without its being blocked and secured properly.

How might a different crane have prevented this accident?

A crane that wouldn't require the replacement of the sheave wheel as part of the normal work routine would have eliminated the need for the miners to work underneath the boom.

What About Our Site?

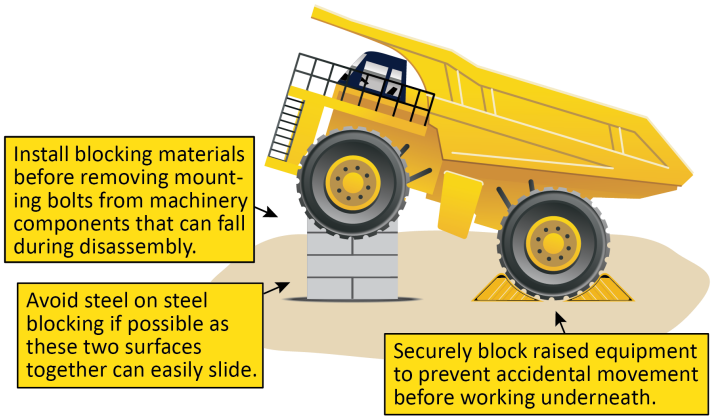
Can you relate to or give any examples of similar situations to the accidents above?

What potential similar hazards exist at our mine?

All of us—miners and management alike—have responsibility for safety at the mine. How can we ensure that these accidents don't occur here?

Best Practices

Ask participants to develop their own best practices for working on equipment that could move. The following are recommended best practices that you can add if participants don't:



- Always treat the system as unblocked until the blocks or jack stands are fully loaded and equipment stability has been verified.
- Study the manufacturer's maintenance manual for safety precautions and recommended blocking securing procedures BEFORE initiating repairs.
- Securely block raised equipment to prevent accidental movement before working underneath.
- Ensure that equipment operators communicate with others in close proximity to their equipment.
- Recognize hazardous work procedures, such as working under the boom of a crane.
- Don't use a come-a-long in lieu of blocking raised equipment.
- Ensure that there is sufficient space around the equipment to perform the work safely and out of travelways.
- Prep the area under the equipment to ensure that the bottom layer of the blocks or jack stand will lie within a flat and level area. Use bearing plates to increase the contact area with the ground under the blocks or jack stand if the ground's ability to support the load is questionable.
- Ensure that the ground on which blocking is to be placed is capable of supporting the loads transferred from the equipment. To prevent the blocking from punching into the ground, use larger plates or blocking to spread the load over a wider area.
- Never use a wooden block that is significantly lighter than the others being used.
- Never use blocks exhibiting rot, splits, twists or bows.
- Avoid using long, slender members as blocking in situations where the blocking will be loaded in compression. These types of members may be prone to buckling failure.
- Ensure adequate contact area with equipment components being supported to avoid crushing the blocks and to increase stability.
- Watch blocking and jack stands during loading to ensure they remain solid without any tilting or sliding.
- Ensure that wooden blocks stacked in a cribbing fashion have their middle portions supported by lower layers to prevent block bending.
- Avoid steel on steel blocking if possible as these two surfaces together can easily slide. Also, remove any grease, etc., from the machine area that will contact the blocking.
- If provided, always use the manufacturer's provided safety device or features for securing components against motion.
- Install blocking materials before removing mounting bolts from machinery components that can fall during disassembly.
- Keep standard transmission vehicles in neutral with the park brake engaged when servicing.
- Position yourself out of the path of travel in the event a failure occurs. For instance, the vibration of a running motor may cause blocked or jacked equipment to move or fall off of its blocks or jacks.
- If available, use a pit to perform maintenance work on the underside of mobile equipment.

BLOCKING

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Scenario 2

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What Went Wrong?

How might a different crane have prevented this accident?

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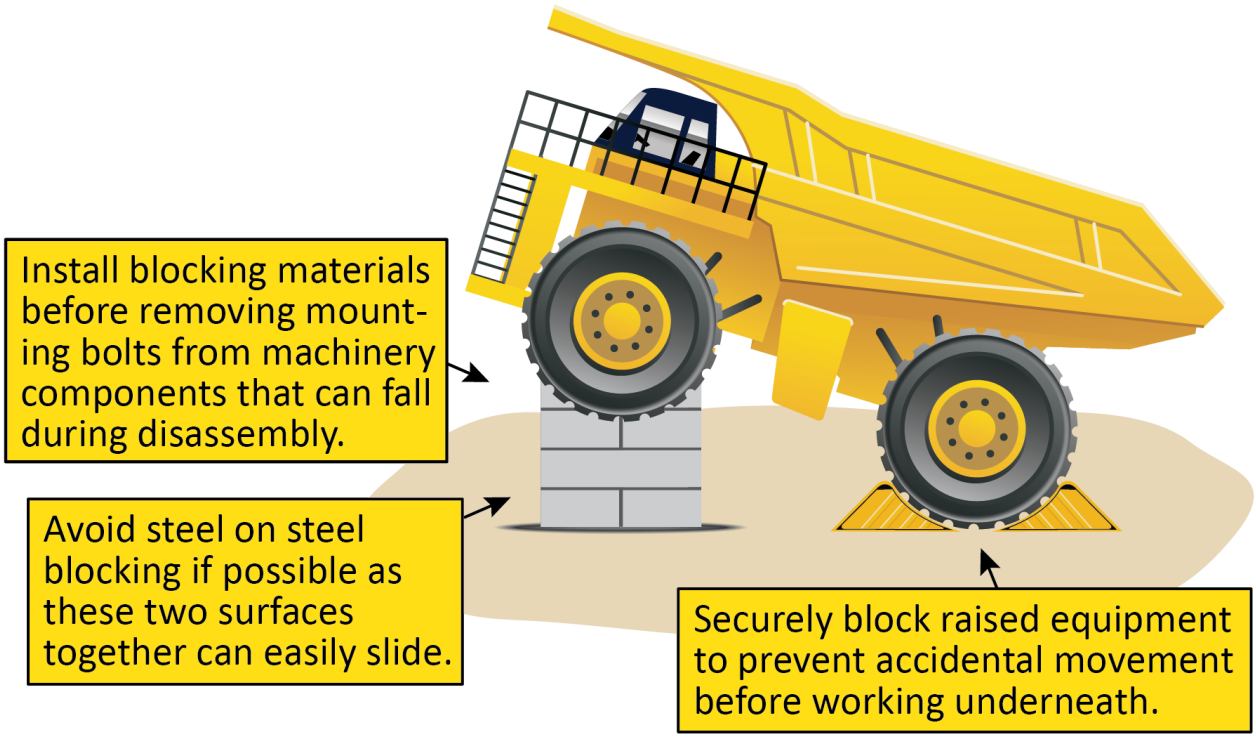
What are some best practices for working on equipment that could move?



Instructor

ELECTROCUTION

Toolbox Training

Choose one or more scenarios that best fit your site. Review the best practices.

Scenario 1

A 46-year-old face equipment operator with 30 years mine experience was working with a qualified electrician underground preparing to connect a high voltage coupler to a receptacle labeled "FEED THROUGH" on a 7,200 VAC high-voltage switch house. The electrician thought the receptacle was incorrectly labeled and that it was actually an output receptacle. After opening the visual disconnect and cleaning the coupler and removing an inappropriately located dust cover from the feed-through receptacle, he went to the personnel carrier. The receptacle remained energized, however, because a bent pilot (monitor) pin short circuited the failsafe ground check system in a coupling in the adjacent belt transformer. The electrician did not lock out, tag out, and ground the circuit because the mechanism on the disconnect lever used for locking out was out of alignment, removing any convenient means of locking out. The electrician also decided that work was to be performed within sight of the disconnect, so the lockout wasn't necessary. When the face equipment operator contacted the feed-through receptacle, he was electrocuted.

What Went Wrong?

The workers did not identify the correct high voltage receptacle, de-energize and ground, lock and tag out the circuit, provide a functioning failsafe ground check circuit, and properly maintain the system, as evidenced by the bent pilot pin that created the short. The wrong caps used on the feed-through and output receptacles.

Scenario 2

A 39-year-old miner with 22 years of mining experience was welding to connect two pipes together in a coal preparation plant. He was working in the ceiling of the filter room, a confined space. The area was wet because the miner had washed out coal dust before welding and cutting to help prevent fire from occurring. The temperature the day of the accident was hot, and the humidity in the plant was high. Workers had to cool down frequently in this area. The welding electrode being used was damaged and deteriorated along its entire length, especially within 72 inches of the miner. The miner also had excess electrode welding pulled up close to him while welding in the filter room. Lighting in the room was poor as well with the man having to rely on an LED on his hardhat. At some point, the electrode went into the man's mouth and he was electrocuted.

What Went Wrong?

The confined area, high temperature, and high humidity lowered the miner's resistance to electric shock. The damaged electrode was unsafe. The welder should also have had an insulating safety mat/blanked on which to work in confined areas or wet spaces. The poor lighting should also have been improved. The miner had to remove his hardhat when welding, then retrieve it in the poor light when he was done.

Scenario 3

A 52-year-old electrician was troubleshooting the dragline training cable at a surface mine. While he was working on the cable, the dragline crew started the auxiliary diesel generator onboard the dragline, and closed (energizing) the auxiliary power circuit breaker to operate the heat and lights through the dragline's auxiliary power supply. Closing the auxiliary circuit breaker back fed power from the dragline back to the junction box. The electrician had not locked and tagged out or isolated the auxiliary power supply. He only disconnected and locked the visual disconnect for the normal power supply that feeds the dragline. There also was no safety transfer switch in the 480-volt auxiliary power supply circuit. A dragline oiler (unauthorized personnel) had obtained a key to the electrician's lock and opened the gate to the enclosure for the auxiliary power circuit breaker control panel and closed the breaker. A short time later the electrician was electrocuted when he contacted two 23,000-volt energized phases in a junction box, which had been energized by the back feeding from the auxiliary generator.

What Went Wrong?

Lockout and tagout were not followed correctly. Procedures weren't in place to guard against back feeding. An unqualified person energized the auxiliary onboard power supply. The electrician also should have grounded the phase conductors to the system ground.

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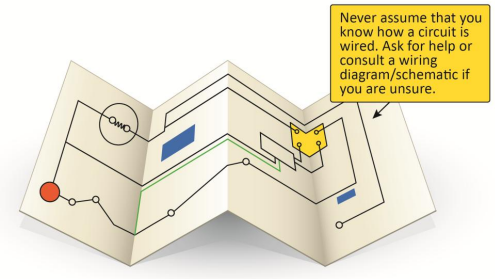
All of us—miners and management alike—have responsibility for safety at the mine. How can we ensure that these accidents don't occur here?

Best Practices

Ask participants to develop their own best practices for working safely with electricity. The following are recommended best practices that you can add if participants don't:

- Lock out and tag out the equipment before starting any work to ensure that it cannot be powered up while you are performing your work. Do not rely on someone else to do these things for you.
- Ensure that electrical work is performed only by a qualified person or one trained to perform electrical work under the direct supervision of a qualified person.
- Mark all circuit breakers and disconnecting switches properly for identification purposes.
- Ensure that the contacts of the appropriate visual disconnecting device are open and locked out.
- Use proper equipment (gloves, multimeter, etc.) when performing electrical work.
- Ensure that complete and thorough examinations of electrical equipment are performed and that electric equipment is maintained to ensure safe operating conditions.
- Never assume you know how a circuit is wired. Ask for help or consult a wiring diagram/schematic if unsure.
- Use properly rated noncontact voltage testers to ensure that high-voltage circuits are de-energized.
- Thoroughly communicate to determine that it is appropriate to reset a breaker.
- Locate the disconnecting means for the circuit to be worked on.
- Test the circuit to be worked for voltage to ensure no electricity is present. Test to identify any stray electrical currents. Do repair work at a safe distance from any energized cables.
- Carefully de-energize the circuit.
- Ground all the phase conductors to the equipment-grounding conductor with a jumper.
- Familiarize yourself with the work area and be aware of any hazards.



Ask participants to provide tips to avoid electrocution when welding. The following are recommended best practices that you can add if participants don't:

- Do not touch an energized electrode with bare skin.
- Avoid wet working conditions. A person's perspiration can lower the body's resistance to electrical shock. Do not drape electrode wires or leads over your body.
- Work in a confined space only if it is well ventilated and illuminated.
- Do not use the plant structure as the work (return) conductor. Connect the work cable (return) as close to the welding area as practical to prevent welding current from traveling unknown paths and causing possible shock, spark, and fire hazards.
- Insulate yourself from work and ground by using and/or wearing dry insulating mats, covers, clothes, footwear, and gloves. Inspect welding gloves for damage before welding and ensure the gloves are dry.
- Use only well-maintained equipment. Frequently inspect welding wires or leads for damaged or exposed conductors. Replace or repair wires or leads immediately if damaged.
- Use voltage reduction safety devices (if available) for arc welders.

ELECTROCUTION

Toolbox Training

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What Went Wrong?

What About Our Site?

Can you relate to or give any examples of similar situations to the accidents above?

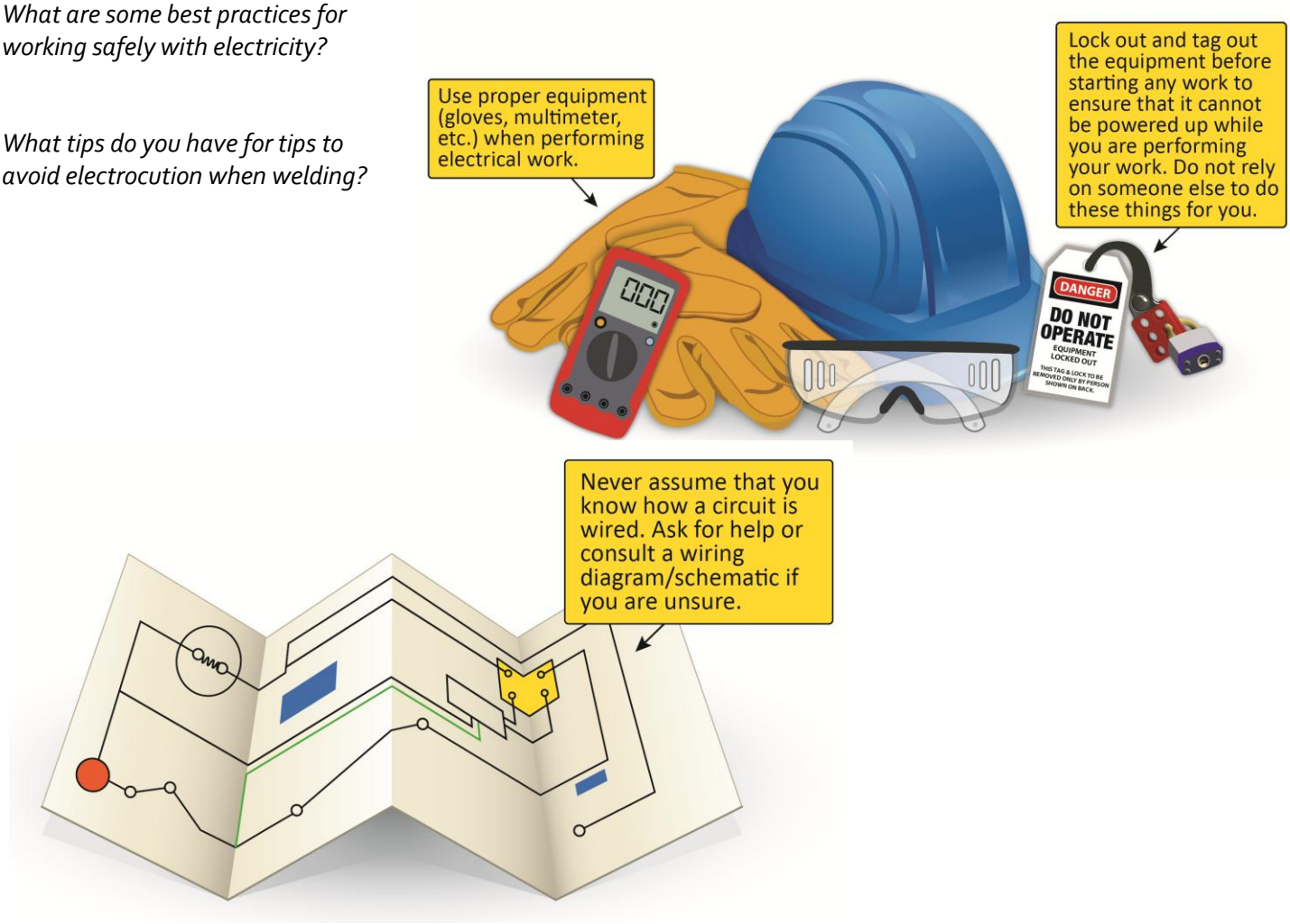
What potential similar hazards exist at our mine?

All of us—miners and management alike—have responsibility for safety at the mine. How can we ensure that these accidents don't occur here?

Best Practices

What are some best practices for working safely with electricity?

What tips do you have for tips to avoid electrocution when welding?



Choose one or more scenarios that best fit your site. Review the best practices.

Scenario 1

A 42-year-old floor walker/ mechanic with 17 years of experience was replacing an 8-inch media pipe above the third floor walkway of a preparation plant. When he loosened nuts on the 40-inch section of pipe he was working on, the pipe flexed, causing the mechanic to drop the impact wrench he was using. The wrench landed on a 6-inch channel along the outer wall of the plant. The mechanic, who was not wearing fall protection, was on the walkway, which was 19.4 feet above the first floor of the plant and had a standard 42-inch high steel handrail securely in place along the entire length of its open side. The open area between the walkway and the channel where the wrench lay was 3.4 feet, and the channel was 1.8 feet below the floor of the walkway. The mechanic fell to the first floor trying to retrieve the wrench and died two months later from his injuries.

What Went Wrong?

The mechanic should have been wearing fall protection, such as a harness. He should not have climbed over or through the railing.

How might the mechanic have retrieved the wrench safely?

He could have relied on a safety harness while reaching for it. He also could have had a coworker tied off and spotting him. A scissors lift also might have been used to get near the channel if there was adequate clearance. He also could have called for another wrench if he had a radio or simply have gone and gotten another wrench himself.

Scenario 2

A 44-year-old preparation plant operator with 25 years of mining experience was supervising various operations at an upper level of the plant. Workers had removed a four-foot square of metal grating on the floor to allow steel parts for a new dust control hood to be lowered by a crane. The opening had been protected with nylon rope and flagging at all three access routes to the opening. The opening in the floor was left throughout the shift so other parts could be lowered. At one point the operator, not wearing fall protection, by himself went under the ropes and entered the area with the opening. He fell 19 feet through the hole, landing on a conveyor belt and suffering fatal injuries.

What Went Wrong?

The opening was left unattended and unprotected by a railing, barrier, cover, or other protective device. The operator and others who worked near the hole did not use a safety belt or safety line for fall protection.

If the opening was necessary long term because of the construction, what protection besides the nylon rope and flagging could have been used to make it safer when unattended?

A steel railing could have been erected. A large steel cover could have been placed over the hole temporarily and moved when materials needed to be delivered through the hole. A wooden barrier could have been erected around the hole.

Scenario 3

Five miners were working on the top deck of a two-deck steel work platform that was suspended in a 22-foot wide ventilation shaft being built 730 feet deep into a mine. A section of steel grating covering an opening in the center of the platform was removed to facilitate removal of the concrete remix (a special pipe used during concrete pours in the shaft). While three of the workers were facing the shaft wall and away from the opening and the other was steadying a hook on the end of the hoist rope with his back turned to the hole, the other miner fell through the hole, landing at the bottom of the shaft 38 feet below. He had been wearing a full-body harness and a lanyard, but the lanyard was not tied off to a suitable connection. He died from his injuries.

What Went Wrong?

The miner did not tie off properly.

Of the five miners working on the platform, which ones would have been required to wear fall protection and wear it effectively?

Because of the opening in the platform, all of them would have been required to wear adequate protection.

What About Our Site?

Can you relate to or give any examples of similar situations to the accidents above?

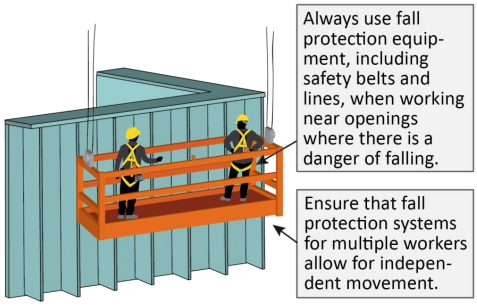
What potential similar hazards exist at our mine?

All of us—miners and management alike—have responsibility for safety at the mine. How can we ensure that these accidents don't occur here?

Best Practices

Ask participants to develop their own best practices for avoiding slips and falls and safely working on platforms or using hoists. The following are recommended best practices that you can add if participants don't:

- SLAM—Stop, Look, Analyze, and Manage the hazards for each task.
- Identify potential fall hazards before each project and during daily walkarounds.
- Always use fall protection equipment, including safety belts and lines, when working near openings where there is a danger of falling.
- Ensure that fall protection systems for multiple workers allow for independent movement.
- Establish work procedures to eliminate creating openings through which persons may fall.
- Protect accessible floor openings with substantial railings or barriers to prevent falls. Cover openings with substantial material when the opening is not in use.
- Restrict access and post warning signs if a surface is not specifically engineered and constructed to serve as a walkway. If access is possible, provide proper fall protection for workers.
- Post warning signs at all approaches to barricaded areas.
- Use safety net systems to supplement harnesses and fall arrest devices.
- Replace deteriorated floor plating and grating.
- Remember that it is better to use fall *prevention* systems, such as guardrails, than fall *protection* systems, such as safety nets or fall arrest devices.



- Regardless of height, provide guardrails and toeboards if a worker can fall into or onto dangerous machines or equipment.
- Have the hoist operator confirm that everybody has tied their safety lanyards to a designated attachment point before moving the hoist.
- Inspect the crane or derrick before suspending a work platform. Inspect the wire rope, hoist drum brakes, boom, and other mechanical and rigging equipment. Platform perimeter protection should consist of a top rail approximately 42 inches above the floor, a toeboard at least 4 inches high, and a midrail halfway between the top rail and toeboard.
- Never sit on, lean against, or step on a skylight or any covering placed over a hole in a roof or floor.

Ask participants to develop their own best practices for using ladders safely. The following are recommended best practices that you can add if participants don't:

- Maintain ladders free of oil, grease, and other slipping hazards.
- Do not load ladders beyond their maximum intended load.
- Use ladders only on stable and level surfaces unless secured to prevent accidental movement and away from areas where they might be displaced by traffic or activity. Use barricades if necessary.
- Face the ladder when moving up or down.
- Use at least one hand to grasp the ladder when climbing; do not use the top or top step of a stepladder as a step.
- Do not use cross-bracing on the rear section of stepladders for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.

FALLS

Scenario 1

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What Went Wrong?

How might the mechanic have retrieved the wrench safely?

Scenario 2

A 44-year-old preparation plant operator with 25 years of mining experience was supervising various operations at an upper level of the plant. Workers had removed a four-foot square of metal grating on the floor to allow steel parts for a new dust control hood to be lowered by a crane. The opening had been protected with nylon rope and flagging at all three access routes to the opening. The opening in the floor was left throughout the shift so other parts could be lowered. At one point the operator, not wearing fall protection, by himself went under the ropes and entered the area with the opening. He fell 19 feet through the hole, landing on a conveyor belt and suffering fatal injuries.

What Went Wrong?

If the opening was necessary long term because of the construction, what protection besides the nylon rope and flagging could have been used to make it safer when unattended?

Scenario 3

Five miners were working on the top deck of a two-deck steel work platform that was suspended in a 22-foot wide ventilation shaft being built 730 feet deep into a mine. A section of steel grating covering an opening in the center of the platform was removed to facilitate removal of the concrete remix (a special pipe used during concrete pours in the shaft). While three of the workers were facing the shaft wall and away from the opening and the other was steadying a hook on the end of the hoist rope with his back turned to the hole, the other miner fell through the hole, landing at the bottom of the shaft 38 feet below. He had been wearing a full-body harness and a lanyard, but the lanyard was not tied off to a suitable connection. He died from his injuries.

What Went Wrong?

Of the five miners working on the platform, which ones would have been required to wear fall protection and wear it effectively?

What About Our Site?

Can you relate to or give any examples of similar situations to the accidents above?

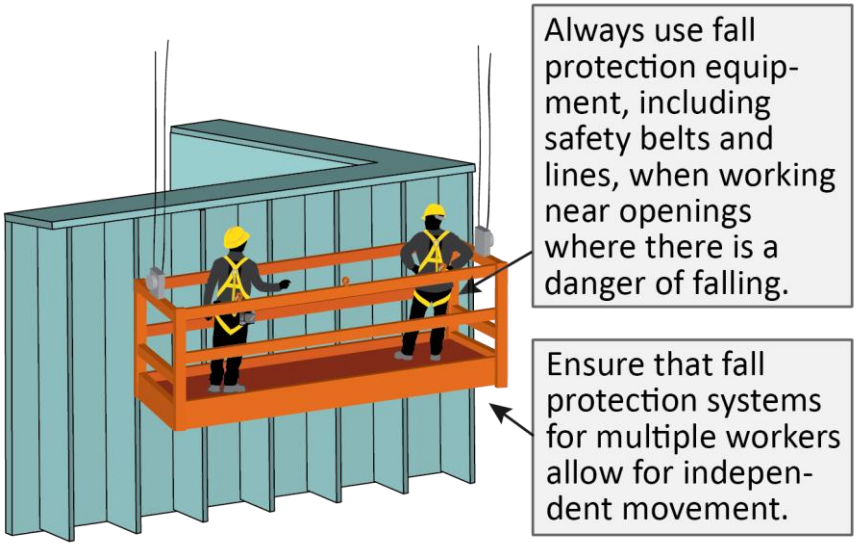
What potential similar hazards exist at our mine?

All of us—miners and management alike—have responsibility for safety at the mine. How can we ensure that these accidents don't occur here?

Best Practices

What are some best practices for avoiding slips and falls and safely working on platforms or using hoists?

What tips do you have for using ladders safely?



Instructor

HIGHWALL COLLAPSE

Toolbox Training

Choose one or more scenarios that best fit your site. Review the best practices.

Scenario 1

A 51-year-old excavator operator and a 38-year-old bulldozer operator were working on the pit floor below a 275-foot, mile-long highwall. The highwall intersected numerous coal seams that had been heavily mined both underground and at the surface for nearly 120 years. The two asked the foreman to check the top of the highwall at the beginning of the shift because rocks had fallen since the previous day. It also had rained and snowed for three days. The low wall (spoil/backfill) opposite the highwall also had sloughed off the previous night and needed to be removed from the pit before coal could be loaded. The foreman saw cracking above the highwall and told the operators to work toward the low wall. He did not go into the pit to examine the face of the highwall. About 40 minutes after he left, a 240-foot-wide, 40 foot deep section of the highwall collapsed, filling the pit with approximately 93,000 tons of rock and material, completely covering the equipment, and trapping the miners inside. Because of the unstable conditions, their bodies were not recovered until the next day.

What Went Wrong?

The ground control plan did not adequately address the highwall conditions because of all the previous mining, which left widespread subsidence and a very unstable highwall. The foreman also should have gone into the pit to inspect the face of the highwall, which showed movement of underground pillar remnants.

Scenario 2

A 50-year-old shovel operator with 22 years of mining experience was working below a 45-foot highwall with water draining from the face. The pit was about 200 feet wide and 150 feet long. The highwall had a steep slope angle, nearly vertical, and was made up of a sandy material. The supervisor at the mine examined the highwall at the beginning of the shift, determined it was too tall, and instructed a dozer operator to push the highwall down to a safe height. However, the dozer operator did not do it because of a water pond on top of the highwall that he thought would trap the dozer. Failures of that highwall were not uncommon. At the 5 a.m. break, the shovel operator left the cab and stood against the tracks of the shovel facing the highwall in order to take a toilet break there since the portable toilet was 700 feet away. The highwall collapsed, pinning the man standing up against the tracks. He died from his injuries.

What Went Wrong?

The shovel should not have been allowed to work near the highwall until the highwall was determined to be at a safe, stable height. The operator should not have positioned himself between the machine and the highwall.

What tips do you have for keeping everyone safe during breaks, shift changes, lunch periods, etc.?

Move equipment away from highwalls. Dismount on the side opposite the highwall.

Scenario 3

A 47-year-old lead blaster his 23-year-old helper were in a pickup truck at the bottom of the pit driving below the face of the highwall in preparation of blasting. The pit was about 6,000 feet long and 100 feet wide. The depth varied between 80-120 feet. The mine operator did not notice in his daily inspections a geologic anomaly, a place where two discontinuities (a potential slickenside) intersected, which had been exposed for several days. The slickenside might have been caused by the compaction of soft shale and massive sandstone. Slickensides are surfaces along a fault or subsidiary fracture in the strata where past movement has occurred. The two men were driving by this spot when rock mass fell around 30 feet to the floor of the pit, covering the pickup and killing the two men about 50 feet from the base of the highwall.

What Went Wrong?

The daily inspections did not note the dangerous slickenside. This anomaly needs to be addressed and corrected quickly.

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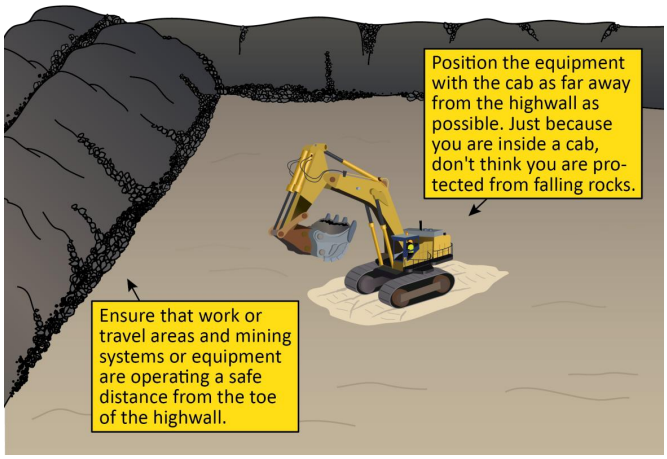
Best Practices



Ask participants to develop their own best practices for working safely around highwalls. The following are recommended best practices that you can add if participants don't:

- Train all miners to recognize hazardous highwall conditions.
- Look, listen, and evaluate highwall and pit conditions daily, especially after each rain, freeze, or thaw.
- Be your own examiner and find hazards before they find you.
- Maintain adequate lighting to aid in examinations of highwalls and pit during low light situations.
- Observe and communicate highwall hazards immediately.
- Remove hazards associated with any anomaly that may appear in the highwall or pit. Promptly correct or post unsafe ground conditions and notify all persons working in the area of the hazard until the unsafe condition is corrected.
- Ensure that work or travel areas and mining systems or equipment are operating a safe distance from the toe of the highwall.
- Never work or position yourself near or under dangerous highwalls or banks.
- Do not work or position yourself between equipment and the highwall so that the equipment might block your escape from falls or slides.
- Position the equipment with the cab as far away from the highwall as possible. Just because you are inside a cab, don't think you are protected from falling rocks.
- When performing maintenance, always position the equipment as far away as possible from the falling material danger zone.
- Be careful trimming the toe of a highwall or spoil bank; trimming can reduce the stability of both.
- Develop ground control plans that specify remedial measures for adverse conditions such as those presented by old underground mines.
- Train examiners to recognize adverse conditions and environmental factors that can decrease stability.
- Involve frontline supervisors when developing mining plans and apply prudent engineering principles to address normal and adverse conditions.

Ask participants what characteristics on or around a highwall or spoil bank might indicate it's unstable. The following are characteristics you can add if participants don't:

- Cracks on the top of the highwall, especially running parallel to the edge, or cracks in the face.
- Constant accumulation of rocks and other debris at the toe.
- Bulging at the toe.
- Exposed rooms from previous underground mining.
- Concentrated seepage.
- Slickensides—striated surfaces along a fault or subsidiary fracture where rocks scrape past each other.
- Weathered soil on spoil banks.
- Recent significant rain or snow.
- Alluvial deposits—rocky material or sediment left when streams or rivers slowed.

HIGHWALL COLLAPSE

Toolbox Training

Scenario 1

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What Went Wrong?

What tips do you have for keeping everyone safe during breaks, shift changes, lunch periods, etc.?

Scenario 3

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What Went Wrong?

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Can you relate to or give any examples of similar situations to the accidents above?

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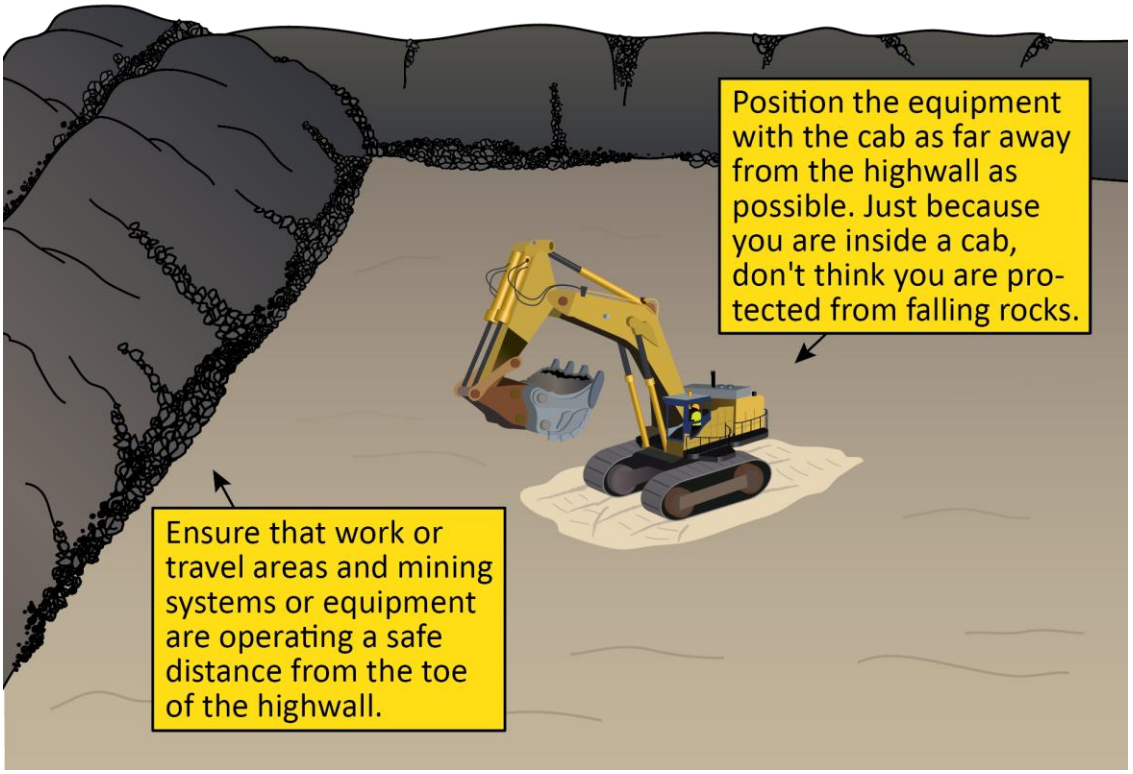
Best Practices

What are some best practices for working safely around highwalls?

What characteristics on or around a highwall or spoil bank might indicate it's unstable?



Instructor

LOCKOUT/TAGOUT

Toolbox Training

Choose one or more scenarios that best fit your site. Review the best practices.

Scenario 1

A 25-year-old section foreman was helping electricians replace two cutter motor torque shafts that had broken on a continuous mining machine. The electricians were able to replace one shaft but could not unjam the other despite repeated attempts. The group had heard that operating the cutter motors momentarily (bumping) would free a stuck torque shaft, though that was not part of the manufacturer's recommended procedure. They reenergized the machine briefly by activating the machine mounted electrical breaker, then hit the panic bar to stop the machine. The shaft was sticking out of the machine 4 inches and was rotating when the foreman began contacting it with a hammer. As the shaft began to exit the motor, it engaged the rotating cutter motor, and the shaft began to rotate in a wide arcing motion, striking the foreman several times in the head and face. The man died of his injuries.

What Went Wrong?

The manufacturer's recommended procedure for replacing the shafts was not followed. Power was not disconnected, torque shafts were not greased, and the and the torque shaft cap, snap ring, O-ring, clutch cover cap and the cutter motor/ clutch access door or cover were not replaced prior to the restoration of electrical power to the machine.

What safety precautions should have been taken?

De-energize power at the power center and disconnect trailing cable. Lockout and tagout. Follow manufacturer's procedure for replacing shafts. Move machine to an intersection if practical. Keep all miners clear during shaft removal except those directly involved.

Scenario 2

A 24-year-old electrician with four years of mining experience was attempting to make an electrical repair on a shuttle car. He used a cable cutter tool to cut into a lead that was energized. He was electrocuted.

What Went Wrong?

Lead should have been de-energized.

If the location of the disconnecting source is a great distance away, what might be a safe alternative for cutting power?

In an emergency you can cut power through an emergency switch, such as a stop cord on a belt line, but locking and tagging out is the only safe alternative for cutting power. When a job requires work or a test to be performed on an energized circuit or machinery motion (without lockout), the work should be performed only when absolutely necessary and only by someone trained and qualified using appropriate tools and equipment.

Scenario 3

A bottom conveyor belt roller needed replaced. A 57-year old fire boss with 15 years of mining experience was assigned to the job. He was lying on the bottom belt surface performing the replacement work when the belt started. The man was carried 49 feet down the belt, then fell from the belt, suffering fatal injuries when landing 39 feet below.

What Went Wrong?

Power to belt should have been locked and tagged out.

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Best Practices

Ask participants to develop their own best practices for performing repairs or doing maintenance on powered equipment. The following are recommended best practices that you can add if participants don't:

- Lock out and tag out the equipment before starting any work to ensure that it cannot be powered up while you are performing your work.
- Locate the disconnecting means for the circuit to be worked on.
- Carefully de-energize the circuit.
- Place your own lock and tag on the disconnecting device. Each employee working on the circuit should place his or her own lock and tag on the device.
- Test the circuit to be worked for voltage to ensure no electricity is present. Test to identify any stray electrical currents. Do repair work at a safe distance from any energized cables.
- Ground all the phase conductors to the equipment-grounding conductor with a jumper.
- Always perform electrical work with persons trained to do such work.
- Familiarize yourself with the work area and be aware of any hazards.
- Ensure your multimeter is working properly. Batteries die quickly. Replace them every three months. Before testing a live circuit, always inspect the probes and leads to ensure the insulation is not damaged and that the leads are plugged in the proper place.

Ask participants to provide tips for testing electrical circuits. The following are recommended best practices that you can add if participants don't:

- Wear your personal protective equipment ("high-voltage" gloves, hardhats approved for electrical work, ANSI approved "EH" footwear).
- If possible, always test the meter on a low energy circuit (typically 120 volt) circuit before each use.
- Use a meter that is properly rated for the testing being conducted.
- Regardless of the voltage rating of the circuit, start at the highest voltage range of the meter and work down to the lowest.
- Select the proper function and range for the measurement.
- De-energize the circuit and discharge all capacitors before attempting in-circuit resistance measurements.
- When measuring current without a current clamp, turn the power off before connecting into the circuit.
- Hang or rest the meter if possible. Avoid holding it in your hands to minimize exposure to any hazards.

LOCKOUT/TAGOUT

Toolbox Training

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What Went Wrong?

What safety precautions should have been taken?

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What Went Wrong?

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Best Practices

What are some best practices for performing repairs or doing maintenance on powered equipment?

What tips do you have for testing electrical circuits?

Instructor

PINNED

Toolbox Training

Choose one or more scenarios that best fit your site. Review the best practices.

Scenario 1

A 47-year-old mine foreman and his crew were preparing to make a conveyor belt set-up. The feeder would require crib blocks under it to elevate the dump end onto the conveyor belt tailpiece. The battery-powered personnel carrier that had the crib blocks loaded unsecured on top of it became stuck while tramming in reverse. When the personnel carrier switch was turned to the forward position, it trammed forward out of control in high tram. Crib blocks had fallen onto the foot controller and blocked the brake from being depressed. The carrier moved forward 8 feet, pinning the foreman against the mine rib, resulting in fatal injuries.

What Went Wrong?

The blocks should have been secured so that they would not have fallen when the direction of the carrier was switched. The foreman was standing in the direct path of the machine as well, instead of to the side.

What could have prevented this accident?

The blocks could have been carried or moved another way. The foreman also should have been aware of his position. Before the switch was moved to forward, the operator should have checked to ensure other workers were in a safe area. Use the proper equipment for the job. In this case a scoop or even a wheel barrel should have been used.

Scenario 2

A 58-year-old section foreman was pinned against an outby bridge conveyor when a trailer loaded with approximately 220 concrete blocks broke free from a scoop that was moving it and rolled down a grade, crushing the victim against the belt. A ¼-inch chain had been looped through a hole in the center of the bucket on the scoop and through a hole in the tongue of the supply car. The scoop operator pulled the supply car, whose weight with the load was estimated at just under 10,000 pounds, or 5 tons. The operator turned sharply into a crosscut where the blocks were needed, the car jerked, and it broke free, rolling 40 feet down a 7.36 percent grade, through a ventilation curtain, striking and pinning the victim, who was shoveling the belt conveyor tailpiece. The victim died.

What Went Wrong?

The supply car was not coupled properly to the tow vehicle. The chain was not strong enough considering how it was used. Others in the general area should have been made aware that the scoop was moving a trailer of blocks at the top of the grade.

What factors could weaken the load capacity of a chain used to tow a load in the confines of an underground mine?

Making a sharp turn could stress a chain if the chain is misaligned, putting additional load on it when it is pulled over and rubbed by the hard corners of the eyes of the tow bar and scoop bucket. If the chain can't slide, more stress is placed on it as well. The chain loop should have been secured with a bolt and nut.

Scenario 3

A 55-year-old continuous mining machine operator was cleaning rock that had fallen from unsupported roof in an entry so that the roof bolting machine could be brought in. After the shuttle car was loaded using the conveyor boom of the continuous miner, the man signaled the shuttle car operator that the car was ready to go and stepped out of the shuttle car operator's sight and along a rib in the outside turn radius of the shuttle. The shuttle car operator, whose visibility was limited with the loaded car, trammed the shuttle out of the area, struck the man, and pinned him against the rib. The man died later of his injuries.

What Went Wrong?

The continuous mining machine operator stood in a hazardous area, positioning himself between the rib and the shuttle car. The operator of the shuttle car had his vision obstructed by the loaded material on the shuttle and the turning angle of the car. MSHA later determined that the mine operator failed to properly implement an existing roof control plan, which was designed to ensure than miners did not position themselves in dangerous areas while mobile equipment is being operated.

What should the operator have done before moving the shuttle car?

The shuttle car operator should have made a visual check on all sides to ensure everyone was in the clear and also should have sounded a warning device before tramming.

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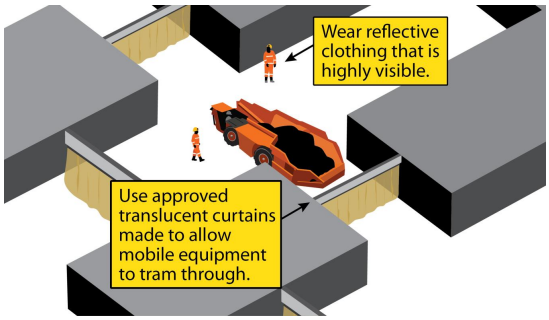
All of us—miners and management alike—have responsibility for safety at the mine. How can we ensure that these accidents don't occur here?

Best Practices

Ask participants to develop their own best practices for avoiding being pinned. The following are recommended best practices that you can add if participants don't:



- Check visually to ensure all persons are in the clear, and sound the warning device before tramming mobile equipment, especially in areas where visibility is limited.
- Never position yourself where equipment operators can't readily see you.
- Maintain good communication between continuous mining machine operators and shuttle car operators so that each is aware of each other's movements.
- Use approved translucent curtains made to allow mobile equipment to tram through.
- Avoid pushing equipment designed to be towed.
- Understand and receive training on proper towing procedures and the safe use of towing hardware/equipment.
- Use only towing hardware (hitches, tow bars, receivers, couplers, pins, pintles, safety chains/cables, etc.) that are properly designed for the load.
- Remember the GOAL when you are operating moving equipment—Get Out And Look. When you are working in a new area in the mine or if conditions have changed in a familiar area, get out of your equipment and inspect the work area before performing your job.
- Never obstruct the vision of the equipment operator with the load.
- Do not operate a vehicle with debris, loose material, or trash in the operator's compartment.

Ask participants to provide tips for being seen by equipment operators at the mine. The following are recommended best practices that you can add if participants don't:

Surface

- Use strobe lights or flags on smaller passenger vehicles so operators of large equipment can readily see them.
- Minimize times where smaller vehicles need to approach large mobile equipment (for example, arrange for haul truck drivers to have supplies available at the preshift meeting place instead of delivering them to the truck). If it becomes necessary to deliver something to a haul truck, stop a safe distance away from it and confirm your presence and intentions.
- Wear reflective clothing that is highly visible (360 degrees) when the arms are up or down or when the body is in any position, even on top of the hardhat.
- Use two-way radio or other effective means of communication with one another in the work area.
- Always confirm your presence with the equipment operator before entering a working pit.

Underground

- Always wear reflective clothing to ensure high visibility, including suitable hardhats with at least six square inches of reflective material on each side and back.
- Notify the equipment operator of your intentions and get confirmation before moving to other areas around the equipment or leaving the work area.
- Communicate your position to equipment operators. Before entering an area you normally would not enter, let the equipment operator know you are there and get acknowledgement you are seen.

PINNED

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What could have prevented this accident?

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What Went Wrong?

What should the operator have done before moving the shuttle car?

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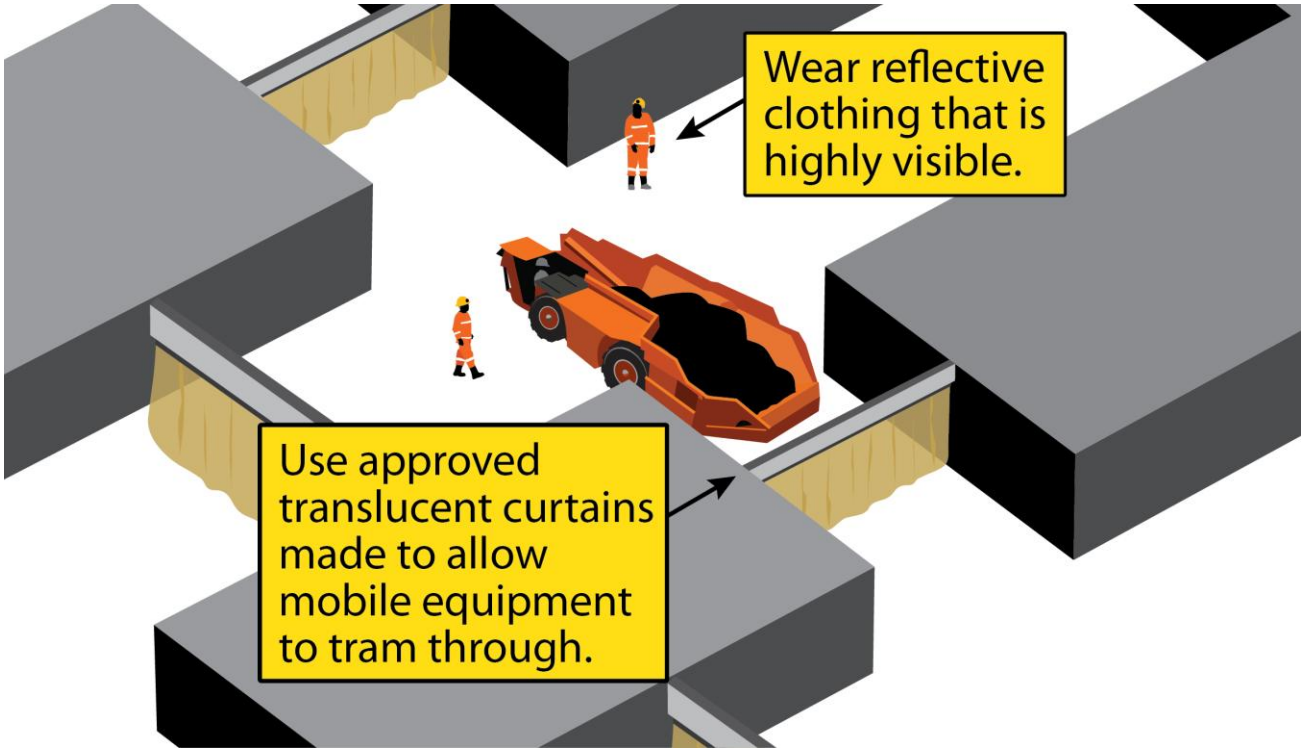
Best Practices

What are some best practices for preventing or avoiding being pinned?



Instructor

ROLLOVER

Toolbox Training

Choose one or more scenarios that best fit your site. Review the best practices.

Scenario 1

A 47-year-old miner with 29 years of experience was operating a hydraulic excavator at a surface mine. Two elevated mine benches had been developed above the pit. The excavator was operating from the top bench, which was 13 feet wide. The excavator tracks were 11 feet, 2 inches wide. A distance of 16 feet, 5 inches would be required for full rotation clearance of the excavator's deck. The excavator was digging out spoil above the coal seam and moving it to the outside of the pit. The excavator's left track was on the edge of the bench, and the right track was spinning. In order to try to center the excavator on the bench, the operator swung the boom to the bench below and placed the bucket on the ground to apply downward pressure to slide the tracks toward center. The excavator rolled to the left over the outslope of the bench, landing on its top and crushing the cab. The operator died in the accident.

What Went Wrong?

The bench wasn't wide enough to safely operate the excavator. The operator had the machine on the edge of the bench in order to get as much rotation clearance as possible while mining the seam.

What are the major points of the ground control plan at your mine that might help prevent an accident such as this?

Answers will vary according to each mine, but the plan, which is required by CFR Subpart K—Ground Control, should address highwalls, pits, spoil banks, benches, etc.

Scenario 2

Miners were developing a new haul road to a proposed pit. The crew was concerned about a row of trees atop a 24-foot-high embankment. To prevent the trees from falling onto the haul road, a 50-year-old pit foreman/machine operator with 26 years of mining experience decided to push the trees over the embankment using a Caterpillar D5M-LGP dozer. The work area at the top of the embankment was reasonably level, 35 feet long and 21 feet wide. The embankment was shale with a top layer of sandy soil. After pushing the first tree in the row over the embankment, the operator pushed the third tree. The second tree also then fell and the dozer traveled over the embankment. The operator was not wearing seatbelts and was thrown from the dozer's cab. Other miners arrived to find him sitting on a stump conscious but having trouble breathing. He died about two hours later.

What Went Wrong?

The operator should have been wearing seatbelts. The operator also should have conducted any clearing or grubbing operations a safe distance from the crest. Large roots can extend several feet from a stump, which can remove or soften ground during extraction.

Were there other options for removing the trees?

"Clear cutters" could cut down the trees.

In what way might the dozer itself played a part in this accident?

The D5 might have been too large for the ground near the crest to support it.

Scenario 3

A 52-year-old contract truck driver with 30 years of experience was driving a truck loaded with coal on a haul road from a surface mine. He had complained of having difficulty with the power steering before the shift and had inspected the power steering fluid but found everything proper. He had received a load of coal with a slight heap that was 37,000 pounds over the manufacturer's maximum gross vehicle weight rating. Overloading was a routine practice at this mine. The driver apparently lost control of the loaded truck and either jumped or was thrown from the cab of the truck. He was not wearing seatbelts. He was run over by the rear tandem axel and died at the scene. Further inspection of the truck after the accident showed worn brakes and an inadequate training program.

What Went Wrong?

The truck was loaded well beyond its maximum load capacity and combined with the inadequate brakes, both contributed to the accident.

What options do drivers have if they have been overloaded?

Refusing to operate an overloaded truck is always an option, although it may be a risky one at some mines. At UMWA mines the driver could invoke his individual safety rights granted by the contract. In this particular case, the mining company instructed drivers not to haul when overloaded.

What About Our Site?

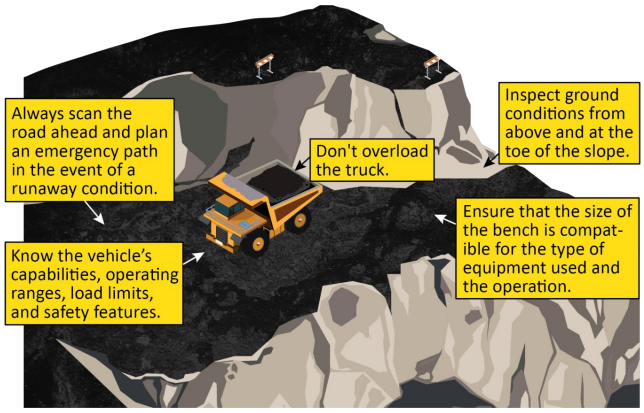
Can you relate to or give any examples of similar situations to the accidents above?

What potential similar hazards exist at our mine?

All of us—miners and management alike—have responsibility for safety at the mine. How can we ensure that these accidents don't occur here?

Best Practices

Ask participants to develop their own best practices for operating heavy equipment safely above ground to avoid rollover accidents. The following are recommended best practices that you can add if participants don't:



- Stop, Look, Analyze, and Manage (SLAM) each task.
- Wear seatbelts when operating mobile equipment. Never try to escape during a rollover by jumping.
- Before working near embankments, check the crest and face of the slope for brows, rutting, cracking, slumping, or other indications of weakness.
- Conduct clearing and grubbing above highwalls, pits, or slopes at a safe distance from the crest. Do not advance the crest into an area that has not been cleared.
- Perform additional checks during the work shift to ensure ground conditions have not changed.
- Inspect ground conditions from above and at the toe of the slope.
- Ensure that the size of the bench is compatible for the type of equipment used and the operation.
- Provide rollover protection for equipment where conditions warrant.
- Conduct preoperational checks to identify safety defects and perform necessary repair work before placing equipment in service, including checking brakes.
- Observe all speed limits, traffic rules, and ensure that grades on haulage roads are appropriate for haulage equipment being used. Adjust the speed to match the road and weather conditions.
- Install reflective markers such as mile markers and additional signage on haul roads so that equipment operators can call out their location over the CB or radio.
- Select the right gear before descending grades and use auxiliary retarders to the fullest extent possible.
- Post recommended gear ranges at the top of grades for haul trucks.
- Install runaway truck ramps along haul roads with steep grades
- Don't overload the truck. If a truck is loaded, dump off the excess material.
- Always scan the road ahead and plan an emergency path in the event of a runaway condition.
- Know the vehicle's capabilities, operating ranges, load limits, and safety features.
- Ensure that contract truckers have an adequate maintenance/inspection program.
- Some operations "drive left" on piles so that on the approach the driver is in a better position to observe the dump area and to check for cracks and make sure that the berm is adequate.
- Install berms that are at least one-half the largest wheel height operating on the haul road.

Dumping points are particularly hazardous for their rollover potential. What tips do you have for safe dumping?

- Always "dump short" of the edge when a pile has been loaded-out below the dump point, at least one truck-length back from the edge, then push the material over with a track-mounted dozer.
- Use the first bucket or two of material to block the ramp going to the top of the pile. Then keep the ramp blocked until any over-steepened slope conditions have been corrected and a berm has been made around the pile.
- Stay clear from trucks when they are dumping.
- Always deflate trailer air springs before raising the dump body.
- After dumping remove "little build-ups" before they become large ones.

ROLLOVER

Scenario 1

A 47-year-old miner with 29 years of experience was operating a hydraulic excavator at a surface mine. Two elevated mine benches had been developed above the pit. The excavator was operating from the top bench, which was 13 feet wide. The excavator tracks were 11 feet, 2 inches wide. A distance of 16 feet, 5 inches would be required for full rotation clearance of the excavator's deck. The excavator was digging out spoil above the coal seam and moving it to the outside of the pit. The excavator's left track was on the edge of the bench, and the right track was spinning. In order to try to center the excavator on the bench, the operator swung the boom to the bench below and placed the bucket on the ground to apply downward pressure to slide the tracks toward center. The excavator rolled to the left over the outslope of the bench, landing on its top and crushing the cab. The operator died in the accident.

What Went Wrong?

What are the major points of the ground control plan at your mine that might help prevent an accident such as this?

Scenario 2

Miners were developing a new haul road to a proposed pit. The crew was concerned about a row of trees atop a 24-foot-high embankment. To prevent the trees from falling onto the haul road, a 50-year-old pit foreman/machine operator with 26 years of mining experience decided to push the trees over the embankment using a Caterpillar D5M-LGP dozer. The work area at the top of the embankment was reasonably level, 35 feet long and 21 feet wide. The embankment was shale with a top layer of sandy soil. After pushing the first tree in the row over the embankment, the operator pushed the third tree. The second tree also then fell and the dozer traveled over the embankment. The operator was not wearing seatbelts and was thrown from the dozer's cab. Other miners arrived to find him sitting on a stump conscious but having trouble breathing. He died about two hours later.

What Went Wrong?

Were there other options for removing the trees?

In what way might the dozer itself played a part in this accident?

Scenario 3

A 52-year-old contract truck driver with 30 years of experience was driving a truck loaded with coal on a haul road from a surface mine. He had complained of having difficulty with the power steering before the shift and had inspected the power steering fluid but found everything proper. He had received a load of coal with a slight heap that was 37,000 pounds over the manufacturer's maximum gross vehicle weight rating. Overloading was a routine practice at this mine. The driver apparently lost control of the loaded truck and either jumped or was thrown from the cab of the truck. He was not wearing seatbelts. He was run over by the rear tandem axel and died at the scene. Further inspection of the truck after the accident showed worn brakes and an inadequate training program.

What Went Wrong?

What options do drivers have if they have been overloaded?

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Can you relate to or give any examples of similar situations to the accidents above?

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All of us—miners and management alike—have responsibility for safety at the mine. How can we ensure that these accidents don't occur here?

Best Practices

What are some best practices for operating heavy equipment safely above ground to avoid rollover accidents?

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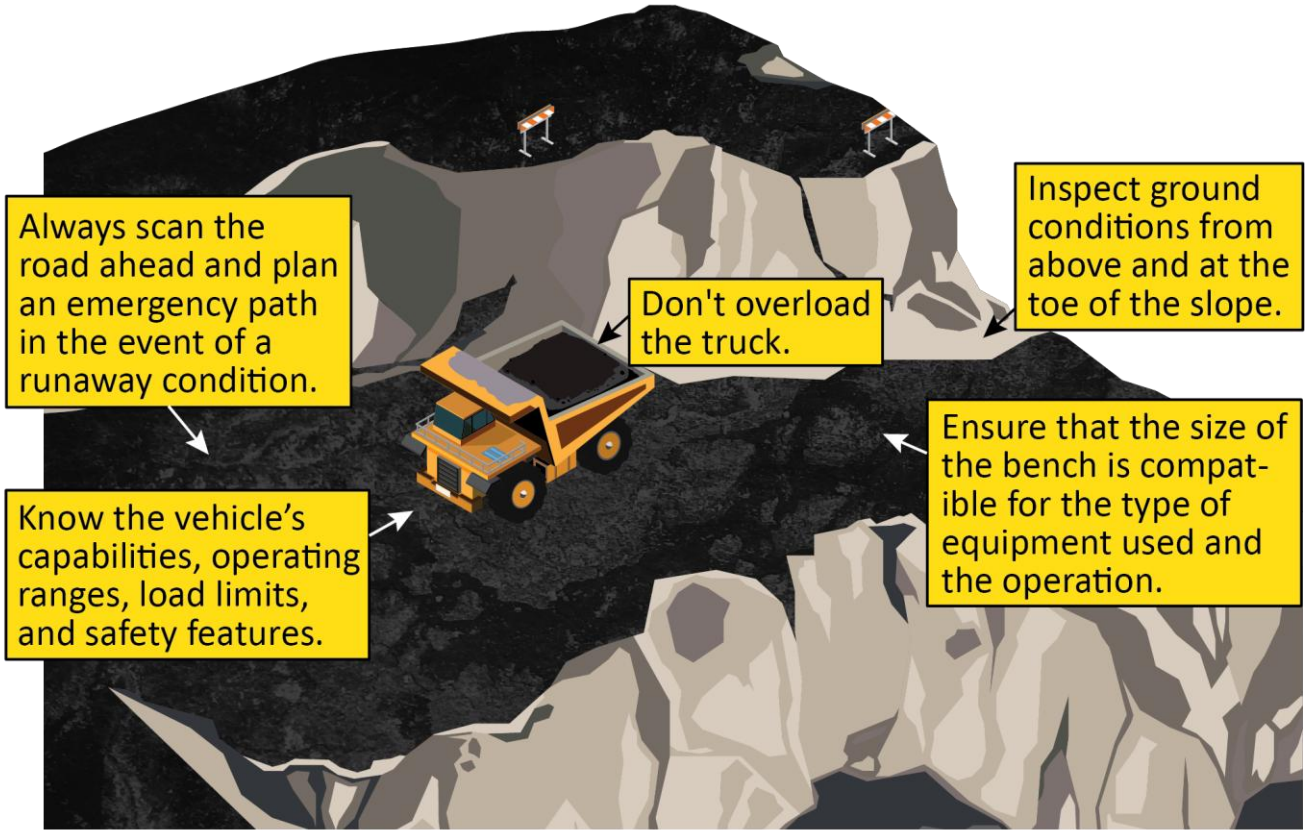


Instructor

ROOF/RIB COLLAPSE

Toolbox Training

Choose one or more scenarios that best fit your site. Review the best practices.

Scenario 1

A 15-foot cut had been mined from an entry on a Friday evening and left standing unsupported over the weekend. On Monday the day shift crew encountered draw rock that had fallen in the original 15-foot lift. The Monday crew used a continuous miner to extract 10 more feet of coal from the face of that entry. That created a brow (a low place in the roof) 15 feet into the cut where the roof dropped quickly down from 8 feet to 6 feet in less than 5 feet. Three roof bolts were spaced wider—56½-58 inches apart—than the normal48 inches because of the angle of the brow. A 56-year-old roof bolting machine operator was killed when a 5½-foot vertical rock brow piece fell on him.

What Went Wrong?

Leaving a 15-foot cut unsupported for two days was the main cause of the accident. A contributing factor was the roof bolt spacing, which was too wide at the area of the brow. Adequate supplemental supports also were not installed.

Why was making an extended cut 25 feet deep in this section unwise?

The evidence of draw rock, the soft shale above coal seams that falls easily from unsupported areas, hinted that the roof was not stable.

How would you deal with the 15-foot cut?

Cut down the loose rock first and then bolt that section.

How can abrupt vertical steps of more than 12 inches be dealt with to facilitate roof bolt installation?

Slope or taper the roof from the upper to lower horizon. Install metal straps, sometimes called "bacon strips."

Scenario 2

A 44-year-old roof bolting machine operator was marking roof bolt placement in a crosscut. Visual, sound, and vibration checks had indicated no adverse roof conditions in this section and no evidence of draw rock. The automated temporary roof support (ATRS) was pressurized against the mine roof. The operator 's canopy was 20 inches from the mine roof instead of as close to the roof as possible as recommended by the company safe work instructions. At that height the operator could not remain under the canopy while marking roof bolt locations. Another operator said it was easier to mark roof bolt placement from outside the canopy. The victim was outside the canopy when falling rock struck and killed him.

What Went Wrong?

By standing outside the canopy, the operator had no protection. The canopy should have been raised closer to the roof to protect the operator. If that's not possible, stay under the canopy!

Another roof bolter said the top of the cut looked smooth. What danger might that hide?

Slickenside—a smooth, striated, polished surface—can fall without warning in areas not yet bolted. Slickensides were found where the roof fell. Slowly bolt your way into these areas or have the miner operator cut the bad top down.

What should you use to make visual, sound, and vibration checks and how often?

Use a sounding stick, hammer, or slate bar for pre-shift exams, right before any work is started, and periodically as conditions warrant.

Scenario 3

The left side and right side integral roof bolter operators on a continuous mining machine were standing at their respective sides of the machine waiting to install the next roof strap in the section they were working. The continuous miner operator had undercut the face, backed up, and just started cutting the top when he noticed the light move from the left side bolter operator. A 23-feet-long, 4-feet-high, 16-inch-thick rock had fallen from the rib and pinned the roof bolter operator against the machine. He died from his injuries. The preshift inspection did not indicate any adverse conditions, but later investigation showed a series of curves on the rib, meandering slickensides that ran nearly parallel with the trench rib, then dipped steeply. At the top of the rib was gray claystone. No rib supports were in place on the left rib, and the continuous miner was not designed to install rib support.

What Went Wrong?

The slickensides (a smooth, striated, polished surface produced on rock by friction) allowed the upper gray claystone and some of the underlying coal/shale/claystone to collapse. The roof bolt operator was further in danger because the continuous miner could not install rib support.

When mining in out of seam or adverse areas, what should be considered to ensure safety?

Add rib bolting capability to the continuous miner to protect miners from rib rolls. If that's possible, posts or dukes (hydraulic supports) can be installed to support the ribs.

What About Our Site?

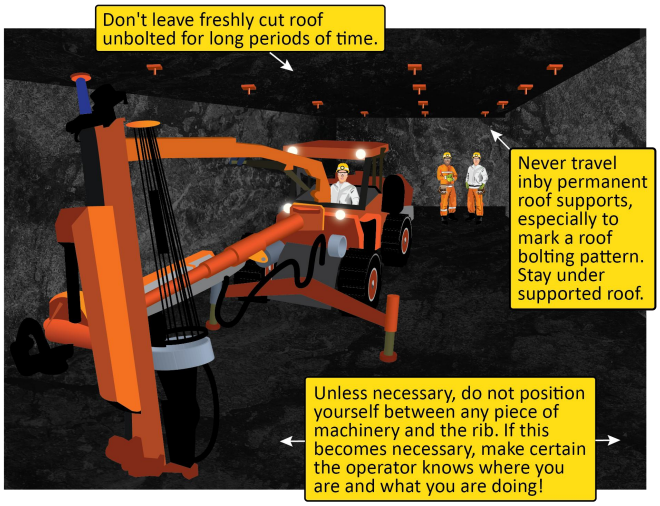
Can you relate to or give any examples of similar situations to the accidents above?

What potential similar hazards exist at our mine?

All of us—miners and management alike—have responsibility for safety at the mine. How can we ensure that these accidents don't occur here?

Best Practices

Ask participants to develop their own best practices for preventing or avoiding roof or rib collapses. The following are recommended best practices that you can add if participants don't:



- Know and always follow your approved roof control plan. Train all miners to identify unsafe roof conditions. Ask veteran miners or inspectors for tips on recognizing potential hazards such as slickensides or excessive draw rock.
- Examine the roof, face, and ribs, including sound and vibrations tests, during pre-shift examinations, immediately before any work is started, and periodically as conditions warrant. Use a sounding stick, hammer, or slate bar.
- Never travel inby permanent roof supports, especially to mark a roof bolting pattern. Stay under supported roof.
- Remain alert for changing roof conditions, and remove hazards immediately. Roof brows that are created by a sudden change in mining height can create unsafe roof conditions.
- Take corrective action immediately if you observe an unsafe condition. Take down or support unstable coal ribs.Get help if you need it and take the time to get the proper tools and materials.
- Don't leave freshly cut roof unbolted for long periods of time.
- Use roof screen, large roof bolt plates, or other surface controls to prevent rocks from falling between supports. Metal straps or pizza pans (large metal/tin pizza-shaped product that the roof bolt plate bolts up to) also help.
- Discuss any roof control concern with your supervisor. Don’t take for granted that he or she knows.
- Share information about changes in roof/rib conditions with fellow miners.
- Keep a bar of suitable length on the roof bolting machine to scale down loose rock. (Pry up, not down!)
- Ensure the ATRS system is in proper operating condition before installing bolts.
- Never operate the roof bolter when the ATRS is inoperative or does not contact the roof.
- Only use manufacturer's approved extensions for ATRS systems.
- Add additional supports at any indication of adverse roof conditions.
- Stay in a safe location under permanent support when installing roof supports. Place yourself in a safe position when located near belts/equipment.
- Where the mining process allows, remain within the confines of protective devices such as cabs, canopies and rib protectors whenever possible. When possible, stay under the roof bolter canopy when working in the area between the ATRS and the last row of permanent roof support.
- Unless necessary, do not position yourself between any piece of machinery and the rib. If this is absolutely necessary, make certain the operator knows you are there and what you are doing.
- Always follow bolt installation sequence.
- Drill all holes to proper depth (not over one inch deeper than the bolt's length).
- Use the proper finishing bit when installing shell.
- Scale any loose or hazardous roof material using proper equipment and work from a safe location.
- Install additional rib support before mining in areas where the roof or floor is cut above or below the coal seam, especially overcasts, loading points, etc. Screen and or strap these areas.

ROOF/RIB COLLAPSE

Toolbox Training

Scenario 1

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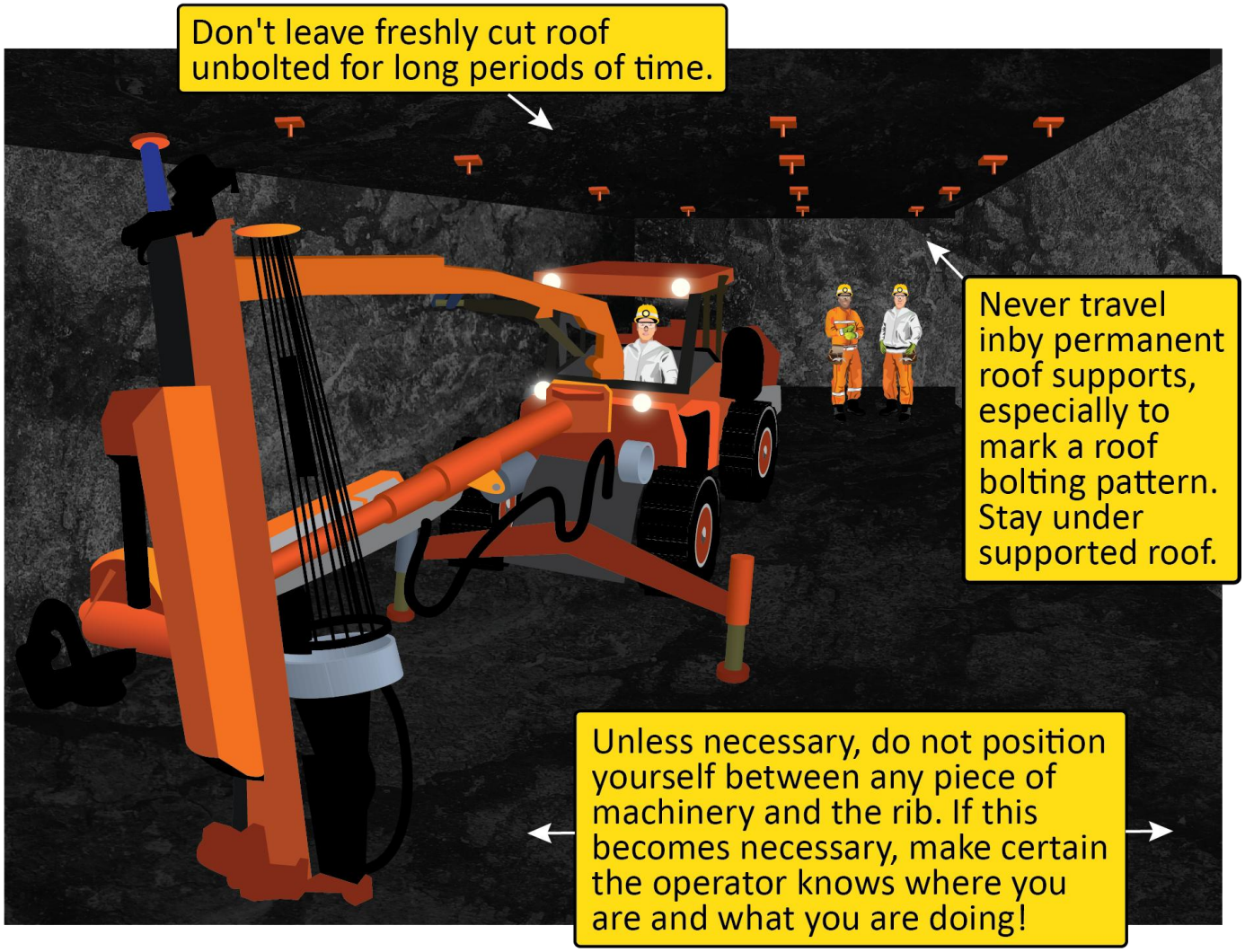

Instructor

STRUCK BY MOVING EQUIPMENT

Toolbox Training

Choose one or more scenarios that best fit your site. Review the best practices.

Scenario 1

A 29-year-old shuttle car operator was standing outside his car dumping his load into the feeder. Another shuttle car operator approached from a perpendicular direction with his coal hauler, or ram car, fully loaded above the sideboards. The ram car operator was unable to see the other man standing next to the feeder. The bucket of the coal hauler struck the man from behind, severing his left leg below the knee and severely crushing his other leg as the man fell into the bucket of the ram car. He died from his injuries.

What Went Wrong?

The ram car was loaded higher than should have been allowed, which obstructed the operator's vision. The victim was standing in a blind spot as well and should not have been next to the feeder in front of the ram car's bucket.

What could have prevented this accident?

If the victim was going to stand away from the shuttle car, he needed to stand safely away from the feeder and also have placed himself in an area to make certain other operators could see him. The ram car operator should have topped off his load when the load reached the sideboards. Shuttle car and ram car operators should stay inside their cab when loading and unloading.

Scenario 2

A surveying crew had been assigned to repair a damaged sight spad in an underground mine using continuous miners and to advance the sights in another section of the mine. The crew's chainman would travel to the first set of sights outby to hang a plumb bob on the sight spad to enable the transitman to shoot a back sight before turning the transit and advancing the sights to the face of each entry. The section foreman spoke briefly with the transitman to inform him where the continuous mining machine was loading, then left. The 50-year-old chainman had traveled 100 feet to a point just outby a run-through check curtain (used as a ventilation control) to prepare for the back sight. This entry is the haulage way for a shuttle car. The shuttle car operator sounded his warning bell and went through the curtain. On his return trip he discovered that the chainman had been run over by the shuttle car and was fatally injured.

What Went Wrong?

The mining crew and the surveying crew did not communicate effectively. The shuttle car operator was not aware of the chainman's location, and the victim did not expect the shuttle car.

What can be done to better ensure the safety of contractors like surveyors underground?

The mine operator should develop procedures to share mining activities with survey crews and make miners aware of contractors. Surveyors also should be trained in mining hazards. Reflective signage should mark haul roads.

Scenario 3

A 59-year-old bulldozer operator and two other operators had parked their dozers in a line along a drill ground access road at a surface mine. The pit foreman had driven in and asked the three operators to move their dozers to allow an idling rock drill to be moved to the area in preparation for a highwall shot. The dozer operators were walking back to their dozers when one stopped the foreman to hand him some time slips, which distracted the foreman for 3-4 seconds. The 59-year-old operator continued toward his bulldozer walking down the middle of the road. After getting the slips, the pit foreman continued backing up his pickup toward the main entrance road but losing sight of the dozer operator. The foreman was using only his side view mirrors because of being concerned with striking dozer blades or the opposite berm on the narrow road. He struck the dozer operator and ran him over. The man died from his injuries.

What Went Wrong?

The foreman had been distracted and lost sight of all three operators. He also did not use his rear view mirror inside the truck or turn around to look over his shoulder to get a better handle on where everyone was.

What should the operator have done before moving the shuttle car?

The victim needed to be aware of the foreman's truck. The foreman also could have used a backup warning signal on the truck or sounded his horn before backing.

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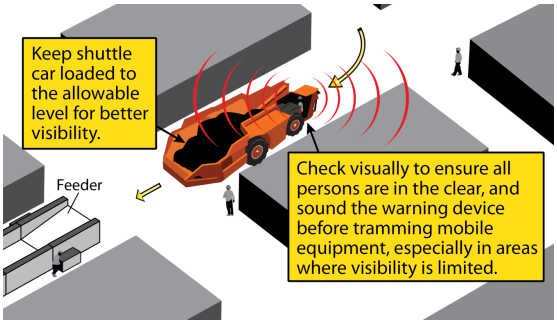
Best Practices



Ask participants to develop their own best practices for avoiding being struck by moving equipment or striking someone while operating equipment. The following are recommended best practices that you can add if participants don't:

- Check visually to ensure all persons are in the clear and sound the warning device before tramming mobile equipment, especially in areas where visibility is limited.
- Never position yourself where equipment operators can't readily see you. Exercise caution and signal your presence to mobile equipment operators. If possible, communicate over a CB or radio.
- Sound warnings when the operator's visibility is obstructed, such as when making tight turns, reversing directions, or approaching curtains. When a shuttle car or ram car is approaching a dumping point or continuous mining machine, they should ring their bell or some audible signal that they are approaching.
- Ensure a travel lane is clear before moving a vehicle. Train miners to not walk or stand in travel lanes.
- When backing up, look over your shoulder to eliminate blind spots. Use all available mirrors.
- Do not travel long distances in reverse, and when able, turn the vehicle around to drive in a forward direction.
- Install rear viewing cameras on vehicles.
- Perform surveying at times when a section is not in production.
- Use approved translucent curtains made to allow mobile equipment to tram through.
- Remember the GOAL when you are operating moving equipment—Get Out And Look.
- Prepare an area where haulage vehicles and equipment operators can safely park during breaks. The area should include ample space for turning and maneuvering when other mobile equipment is present.
- Always wear reflective clothing to ensure high visibility.
- Have operators give the machine's keys to the maintenance person while equipment is being worked on. Keys are returned when the work is finished.
- Do not overload a shuttle car so that visibility is impaired.
- Illuminate dumping points and use a strobe light that comes on when the feeder is running.

Ask participants to provide tips for being seen by equipment operators at the mine or for operators to avoid striking someone while operating equipment. The following are recommended best practices that you can add if participants don't:

Surface

- Use strobe lights or flags on smaller passenger vehicles so operators of large equipment can readily see them.
- Communicate your location by CB or radio.
- Implement a plan that requires operators of any equipment on haul roads to call out their locations at designated marked intervals. Use reflective signage to mark haul roads.
- Require operators to prepare trucks for loading (truck safety inspection, cleaning bed, checking tires) before entering the loading area.
- Instruct loader operators to halt loading activities if the truck operator is outside of vehicle. Use a spotter if needed.

Underground

- Notify the equipment operator of your intentions and get confirmation before moving to other areas around the equipment or leaving the work area. Never take for granted that the equipment operator knows your location.

STRUCK BY MOVING EQUIPMENT

Toolbox Training

Scenario 1

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What Went Wrong?

What could have prevented this accident?

Scenario 2

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What Went Wrong?

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What Went Wrong?

What should the operator have done before moving the shuttle car?

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Can you relate to or give any examples of similar situations to the accidents above?

What potential similar hazards exist at our mine?

All of us—miners and management alike—have responsibility for safety at the mine. How can we ensure that these accidents don't occur here?

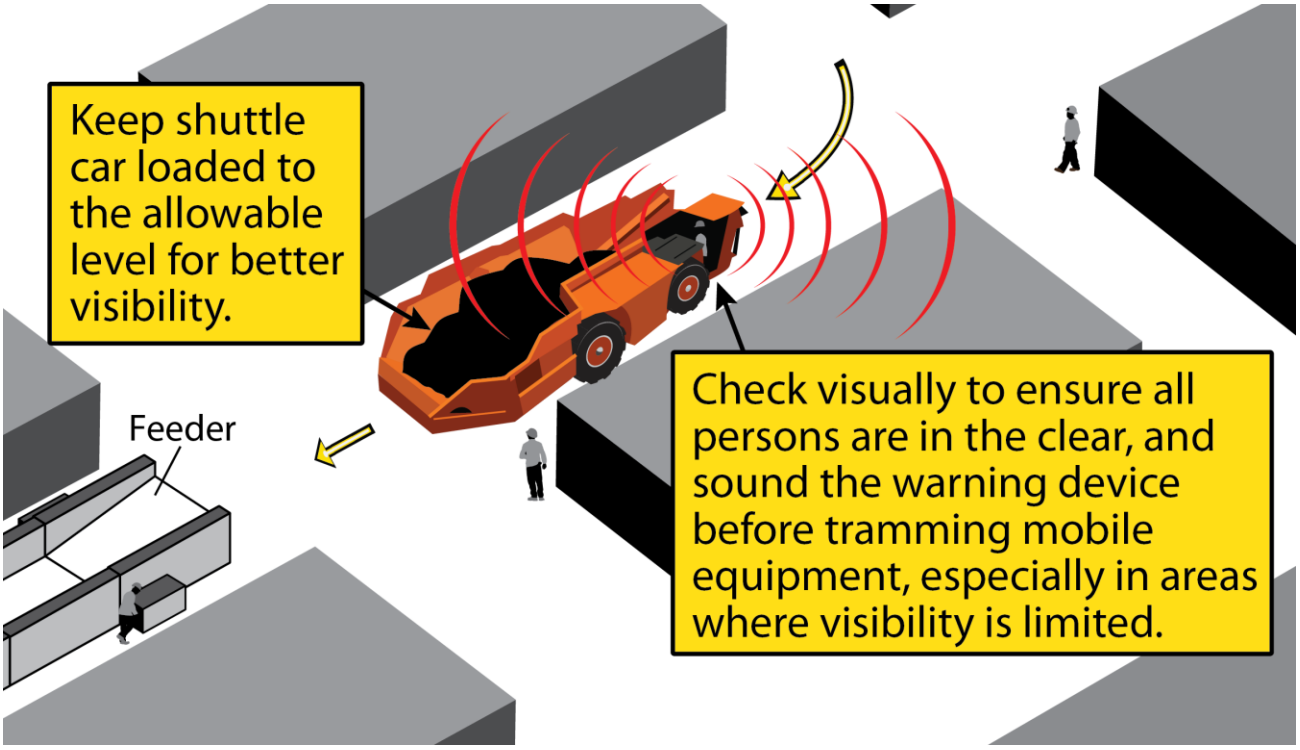
Best Practices

What are some best practices for avoiding being struck by moving equipment or striking someone while operating equipment?

What tips do you have for being seen by equipment operators at the mine or for operators to avoid striking someone while operating equipment?

Surface

Underground



Instructor

STRUCK BY PROPELLED OBJECTS

Toolbox Training

Choose one or more scenarios that best fit your site. Review the best practices.

Scenario 1

A 44-year-old section foreman was operating a battery powered scoop to pull a shuttle car cable across the working section. The foreman had wrapped the plug end of the cable around a post of the scoop's canopy. The scoop ran over the cable during the move, and the cable became lodged between the scoop tire and the mine floor. The end of the cable next to the foreman at the canopy unwound from the post, and the plug struck him in the head. He died from skull injuries.

What Went Wrong?

Wrapping the cable around the canopy post next to the scoop operator was not a safe way of pulling the cable. If something should occur to unwind or dislodge the cable, it will fly from the post with tremendous force.

What would have been a safer way to pull the equipment using mobile equipment?

Use ropes or straps designed for pulling cables. Never attach those ropes or straps to the deck or canopy of mobile equipment close to the operator.

If the scoop is pulling the cable and needs to reverse direction, what should the operator do?

Stop the scoop and reattach the rope or strap to the opposite end of the scoop to pull it in the new direction.

Scenario 2

A company had been contracted to drill wells at a large surface mine operation for future ground cover watering and dust suppression. A bit had gotten stuck 1,900 feet down. A 29-year-old drillhand with new miner training was attempting to free the drill pipe by clamping a wrench on a drill chuck after torque had been applied to the chuck. A ½-inch cable rope, called a snub line, attached to the wrench and derrick was being used to restrain rotation of the pipe under torque. The wire rope was too long to provide the maximum restraint required to hold the torque energy on the pipe. When pressure was released from the drill engine clutches, the rope failed, allowing the tong wrench to rotate. It forcefully struck the drillhand, who had not exited the area. He died from his injuries.

What Went Wrong?

The snub line was inadequate for the size and strength of the load. In addition, no one should have been on the drill deck when the energy was released on the drill pipe, and the clutches should not have been released until all personnel were out of any areas where they could be contacted by moving machinery or tools.

Even though this accident involves a drilling operation, what key lessons can be learned in doing maintenance on machinery?

Make sure equipment isn't energized until it's safe to do so. Ensure that workers are clear from possible moving equipment/tools.

Scenario 3

A 21-year-old utility man/scoop operator was backing a battery tractor/shield hauler into a crosscut. The doors for the operator's compartment had been removed. The right rear tire of the machine ran over a 14-foot length of metal channel that had been lying on the mine floor, which had been noted in a shift the day before had "a lot of loose gravel, mud, and water 1" to 12" deep, being scooped as much as possible." The metal channel flipped up and entered the operator's compartment, striking the operator. He died of his injuries.

What Went Wrong?

The roadway had not been sufficiently inspected for hazards before the shift. Later inspection found metal track ties, wooden crib blocks, metal jacks, and concrete blocks near the accident. The doors of the hauler should not have been removed as well.

What could have prevented this accident?

Thoroughly inspect hazards on roadways before each shift. Do not store or deposit extraneous materials in roadways and travelways. Never alter safety features such as doors and cages on equipment.

What About Our Site?

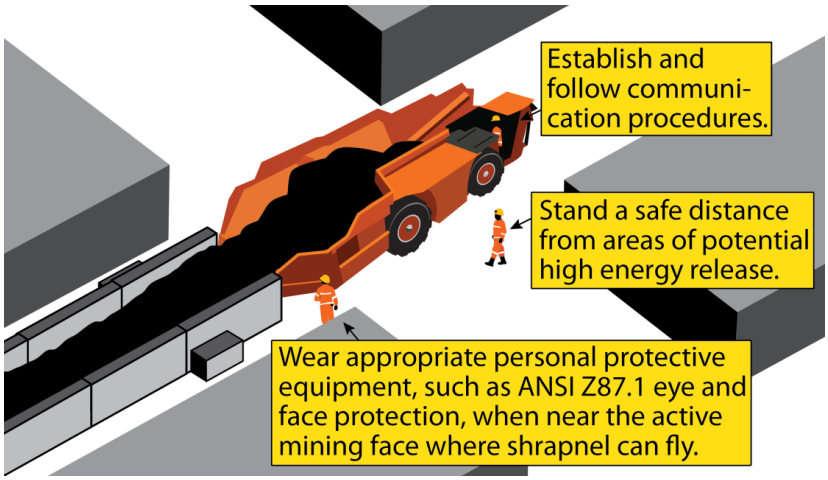
Can you relate to or give any examples of similar situations to the accidents above?

What potential similar hazards exist at our mine?

All of us—miners and management alike—have responsibility for safety at the mine. How can we ensure that these accidents don't occur here?

Best Practices

Ask participants to develop their own best practices for avoiding being struck by propelled objects. The following are recommended best practices that you can add if participants don't:



- Never stand in line with a jammed conveyor to see if the jam is loosening. That's like looking into the barrel of a loaded cannon.
- Wear appropriate personal protective equipment, such as ANSI Z87.1 eye and face protection, when near the active mining face where shrapnel can fly.
- Stand a safe distance from areas of potential high energy release.
- Know the radius of machinery that pivots.
- Ensure all components are adequately blocked and secured to prevent unintended motion.
- Establish and follow communication procedures.
- Never modify the operating equipment, especially any protective devices like doors or canopies.
- Examine active roadways as often as necessary to ensure safety, particularly when hauling loose materials.
- Maintain all roadways free of materials that may pose a hazard to equipment operators, passengers, or miners.
- Emphasize safe operating procedures for equipment and maintenance of roadways in all training programs.

Ask participants to provide tips when working with wire ropes and cables. The following are recommended best practices that you can add if participants don't:

- Ensure that properly designed ropes or slings are used to move cables.
- Do not attach cables to the decks or canopy of equipment being used to pull them.
- Attach cables to be pulled to the end of the equipment opposite to the direction of travel. Reattach to the other end if the direction of travel is reversed.
- Stay away from pinch points and suspended loads, which can lead to injury if the rigging device should fail.
- Inspect devices for signs of wear such as rust, metallic loss, fraying of rope, broken strands in cables, elongation of metal, etc.
- Stay completely out of the direct line of pull of the rope or chain.
- Never weld hooks on equipment in order to attach ropes or chains for towing or hoisting.
- Never remove blocking, release brakes, or otherwise release a load attached to a wire rope without checking the entire length of the rope to make sure it is not slack or snagged on something.
- Apply a wire rope lubricant with a corrosion inhibitor to protect your slope rope from environmental attack.

STRUCK BY PROPELLED OBJECTS

Toolbox Training

Scenario 1

A 44-year-old section foreman was operating a battery powered scoop to pull a shuttle car cable across the working section. The foreman had wrapped the plug end of the cable around a post of the scoop's canopy. The scoop ran over the cable during the move, and the cable became lodged between the scoop tire and the mine floor. The end of the cable next to the foreman at the canopy unwound from the post, and the plug struck him in the head. He died from skull injuries.

What Went Wrong?

What would have been a safer way to pull the equipment using mobile equipment?

If the scoop is pulling the cable and needs to reverse direction, what should the operator do?

Scenario 2

A company had been contracted to drill wells at a large surface mine operation for future ground cover watering and dust suppression. A bit had gotten stuck 1,900 feet down. A 29-year-old drillhand with new miner training was attempting to free the drill pipe by clamping a wrench on a drill chuck after torque had been applied to the chuck. A ½-inch cable rope, called a snub line, attached to the wrench and derrick was being used to restrain rotation of the pipe under torque. The wire rope was too long to provide the maximum restraint required to hold the torque energy on the pipe. When pressure was released from the drill engine clutches, the rope failed, allowing the tong wrench to rotate. It forcefully struck the drillhand, who had not exited the area. He died from his injuries.

What Went Wrong?

Even though this accident involves a drilling operation, what key lessons can be learned in doing maintenance on machinery?

Scenario 3

A 21-year-old utility man/scoop operator was backing a battery tractor/shield hauler into a crosscut. The doors for the operator's compartment had been removed. The right rear tire of the machine ran over a 14-foot length of metal channel that had been lying on the mine floor, which had been noted in a shift the day before had "a lot of loose gravel, mud, and water 1" to 12" deep, being scooped as much as possible." The metal channel flipped up and entered the operator's compartment, striking the operator. He died of his injuries.

What Went Wrong?

What could have prevented this accident?

What About Our Site?

Can you relate to or give any examples of similar situations to the accidents above?

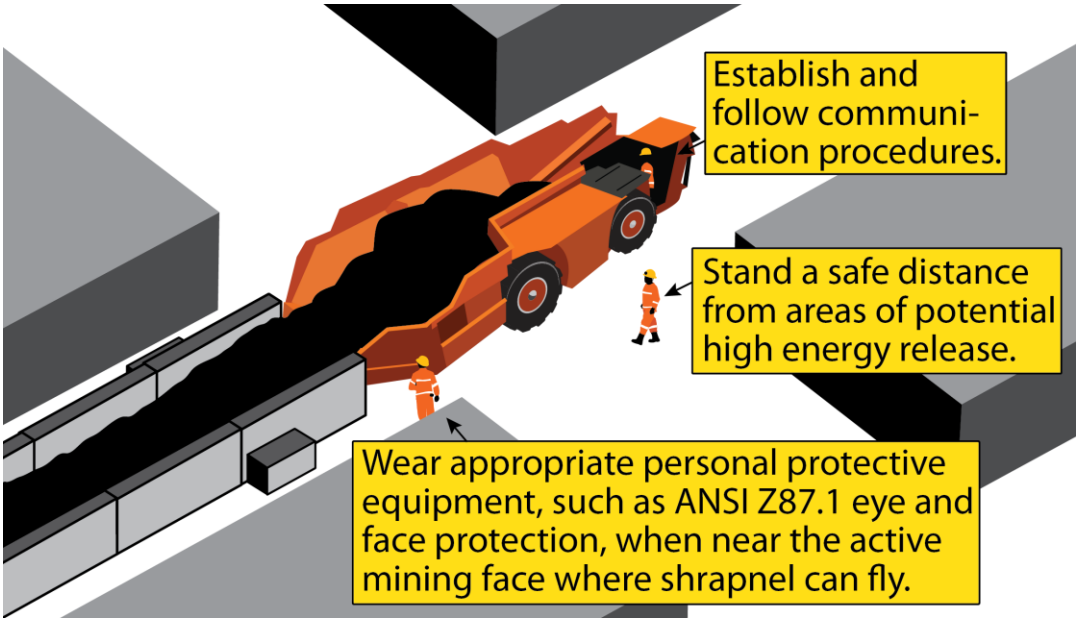
What potential similar hazards exist at our mine?

All of us—miners and management alike—have responsibility for safety at the mine. How can we ensure that these accidents don't occur here?

Best Practices

What are some best practices for avoiding being struck by propelled objects?

What tips do you have for working with wire ropes and cables?



Instructor

UNSECURED EQUIPMENT

Toolbox Training

Choose one or more scenarios that best fit your site. Review the best practices.

Scenario 1

A group of contract truck drivers were taking a lunch break in the pump house, an 8-foot by 8-foot concrete block building near the refuse bin of the preparation plant from which they hauled. The drivers normally met in this building. The four were waiting for the refuse bin to be refilled so they could resume hauling. The last driver had parked his haul truck on a hill above the pump house and left the truck running in neutral. He had set a hand brake but did not set the parking brake. He also did not turn the wheels toward the berm when he parked the truck. A few minutes after he joined the others in the pump house, the truck rolled down the hill and crashed into the pump house. Two drivers were killed, another suffered a broken leg, and the driver of the truck that rolled escaped with minor injuries.

What Went Wrong?

The driver failed to set the parking brake. The hand brake was not designed to serve as a parking brake. The driver also should have turned the wheels toward the berm or highwall so that if the truck did roll while unattended, it would have been stopped from rolling toward the pump house. The wheels also could have been blocked.

Scenario 2

A 35-year-old roof bolting machine operator with five years of mining experience was operating a diesel powered locomotive during a longwall move. Ahead of him was another locomotive pulling a lowboy rail car loaded with a longwall shield. The shield was loaded so that its tip overhung the rail car by 8 feet. The locomotive in front was parked. The roof bolter pulled his locomotive behind the rail car and stopped. He was standing in his operator's compartment, facing the rear of his trip. The brakes were released on his locomotive and it continued forward more than 5 feet, running into the trailing end of the trip ahead. The tip of the longwall shield broke through the Plexiglas windshield of the operator's compartment and crushed the roof bolter against a control panel, killing him. A fresh rub of snuff was removed from the man's mouth to perform CPR, and an open can of snuff was spilled on the deck.

What Went Wrong?

The shield should not have been loaded so that it extended beyond the rail car where it could be contacted by other vehicles. The victim also likely was trying to close or stow the can of snuff and did not set his brakes. He also might have had his attention directed to make certain his load didn't hit other miners to the side of his trip.

What safeguard might have helped on the load on the trip car?

A trip light to help other operators see how close they are to the load in the trip car.

Scenario 3

A 31-year-old contract coal truck driver had lost traction with his tractor and double belly-dump trailers and become stuck on a muddy, snowy uphill grade just beyond the scales at a surface mine about 6 a.m. on a 20-degree day. A miner starting his shift went immediately to a front-end loader that had sat idle during the night and backed it to within 6 feet of the truck's front bumper, set the parking brake, and left the loader to help the truck driver secure a tow chain to tow the truck. The operator did not block the loader from movement (blocking devices were not routinely kept on loading and haulage equipment at the site) or turn it into a bank or berm. After hooking one end of the chain to the rear of the loader, the loader began moving backward down the 8-9% grade. It knocked the loader operator out of the way and crushed the truck driver against the truck's front bumper and grill, killing him.

What Went Wrong?

Water had accumulated in the parking brake system, freezing it and preventing the parking brake from being set. The loader operator had not inspected the equipment before operating it. The operator also failed to block the loader's tires after parking it, nor did he turn the wheels toward a bank or berm.

How could conditions near the loadout be improved?

Maintaining the surface with a deep layer of fresh gravel and fixing ruts would give the trucks better traction.

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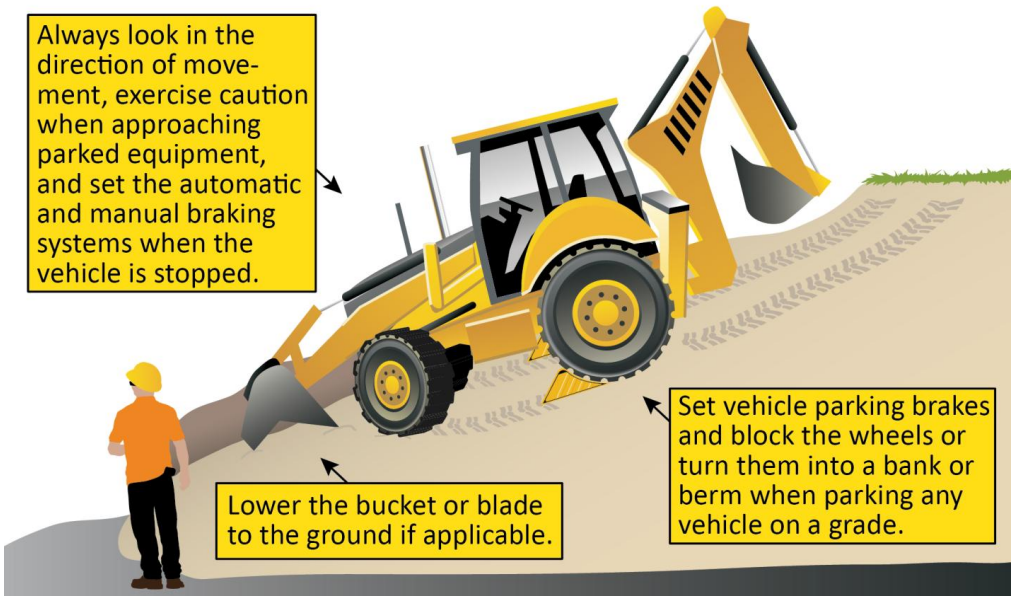

- Set truck parking brakes and block the wheels or turn them into a bank or berm when parking any truck on a grade. Sometimes a vehicle will initially be stationary and in a matter of seconds or minutes it will start to roll away because the tires reshape as they become accustomed to the resistance of the irregular ground surface. The effect is similar to removing an obstacle from under the tire.
- NEVER use a steering column-mounted "dump brake" for parking.
- Maintain equipment braking systems in good repair and adjustment.
- Stop, Look, Analyze, and Manage (SLAM) work areas to ensure that safe work procedures are being followed.
- Conduct preoperational checks to identify any defects that may affect the safe operation of equipment before being placed into service.
- Lower the bucket or blade to the ground if applicable.
- Never try to jump back in the cab to regain control of a runaway vehicle.
- Ensure that shields or other materials loaded for transport do not project into roadways or beyond the haulage equipment and are secured to prevent tipping or falling.
- Place an empty rail car adjacent to overhanging loads or an appropriate draw bar between the locomotive and the load.
- Require trip lights when a tail motor is not used.
- Provide protective cabs, canopies, or vertical intrusion shielding pipes on mobile equipment where clearance permits.
- Always look in the direction of movement, exercise caution when approaching parked equipment, and set the automatic and manual braking systems when the locomotive is stopped.
- Ensure that equipment operators are properly tasked trained.
- Maintain parking brake systems and purge moisture from the system according to manufacturer's recommendations. Maintain mine roads in good condition.
- Provide contract coal haul truck drivers with the required hazard and site specific safety training for each operation that they work.
- Protect brake lines from rock/gravel impact, hoist or towing fixture damage, abrasion from vibrating or rotating components, and the exhaust system or other sources of extreme heat. Also make plans for brake line inspection when using coverings that can hold moisture/mud.

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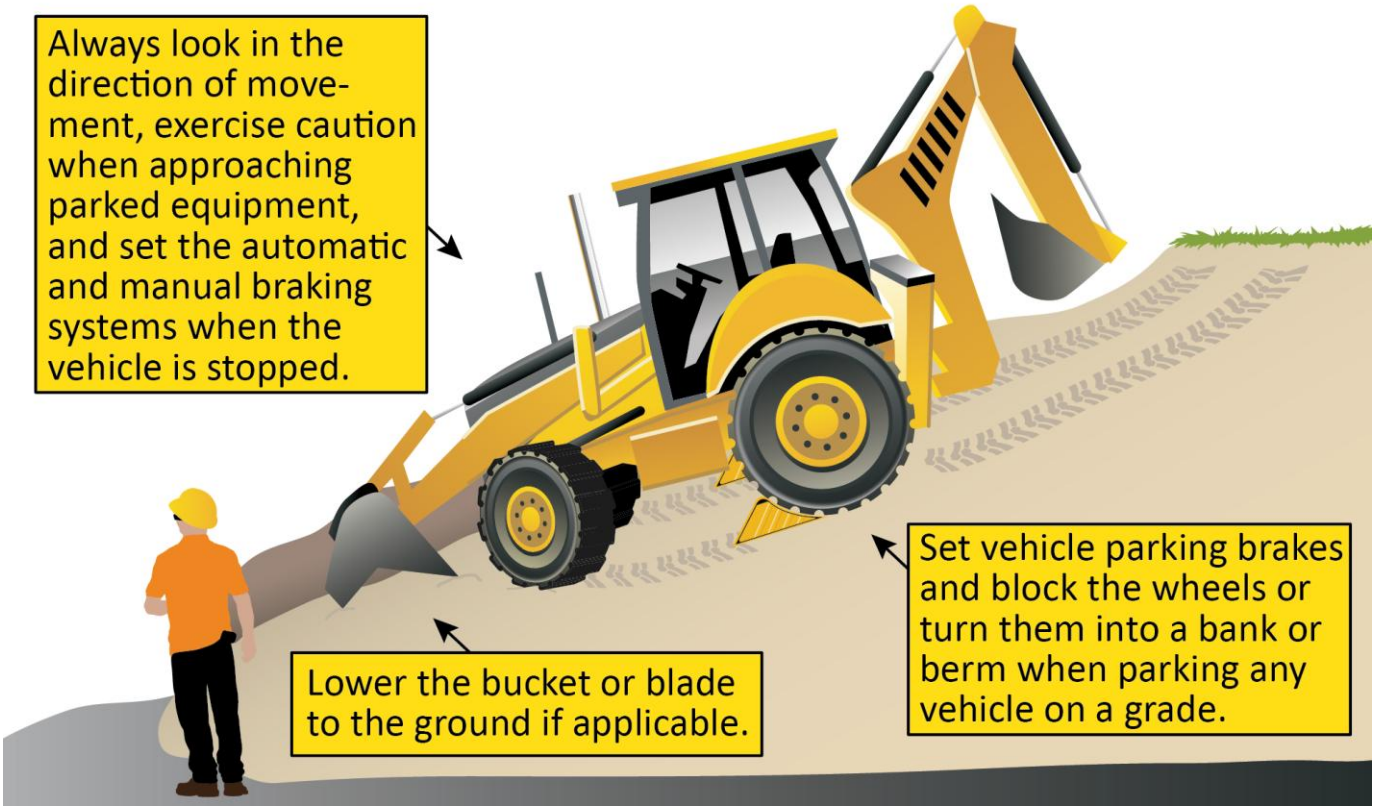

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